THE MARINE REVIEW

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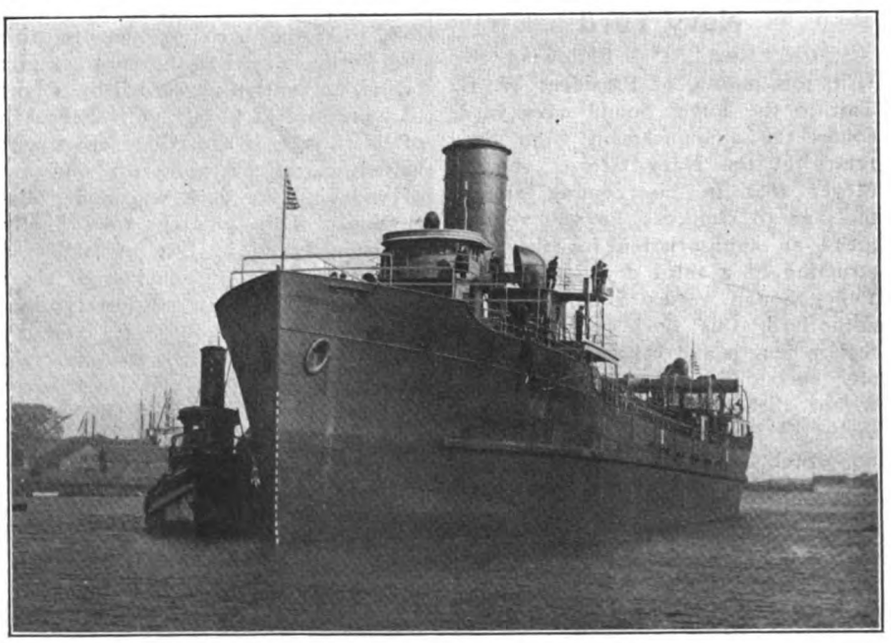
SUCTION DREDGE FRUHLING

THE Fore River Ship Building Co., Quincy, Mass., is building a large twin-screw suction dredge of novel type, designed for use in the southwest pass of the Mississippi river, and to be known as the New Orleans. She is being built for the corps of engineers, war department, and is of the Fruhling suction head type. She was launched Nov. 7. Her dimensions are as follows:

Length over all (not including dredge head)..	315 ft.
Length between perpendiculars	300 ft.
Breadth molded.....	50 ft.
Depth molded.....	26 ft.
Length of hopper.....	93 ft. 9 in.
Capacity of hopper.....	3,000 cu.yds.
Maxi'm dredging depth..	50 ft.
Min'm dredging depth..	21 ft.
Draught loaded.....	20 ft.
Coal bunker capacity.....	300 tons
Speed loaded.....	10 knots

The most novel feature of the dredge is the type of head, which is practically a huge enclosed rake, some 18 ft. wide by 5 ft. fore and aft, serrated along the edge with sharp cutting teeth through the incisors of which is ejected high pressure water to aid in disintegrating the spoil and make it of suitable consistency to be sucked through duplicate suction pipes into the pumps from which it is deposited in either of the ten hoppers. These hoppers have a combined capacity of 3,027 cu. yds., or approximately 3,000 tons, and can be filled under favorable conditions in the remarkably short space of 30 minutes. The dredged material may then be transported by the vessel to any convenient dumping ground at a speed of 10 knots per hour, when by the manipulation of four hydraulic ram mechanisms the hopper doors, 20 in number, and opening outwardly through the ship's bottom, may be operated either individually or simultaneously for discharging. Should it be desired to utilize the dredged material for reclamation work, a swivel deck discharging pipe has been installed, to which the necessary lengths of shore piping may be coupled, and through this pipe the dredge can discharge her own cargo by sucking it from the hoppers and ejecting it to any location desired or, as a third alternative, into scows or other hoppers alongside.



DREDGE NEW ORLEANS BUILT BY THE FORE RIVER SHIP BUILDING CO., QUINCY, MASS.

The machinery consists of four sets of triple-expansion, inverted, marine type engines, arranged in pairs, tandem, and built on common bedplates. The two after sets of these main engines are coupled together to the propeller shafting and the two forward sets to the 26-in. centrifugal pumps used for dredging. By an ingenious arrangement of clutches, the propelling and pumping engines can be coupled together so that the full power of all four engines can be exerted on the twin propellers when desired, while when dredging, the after sets will be free to drive the propellers and the forward sets will drive

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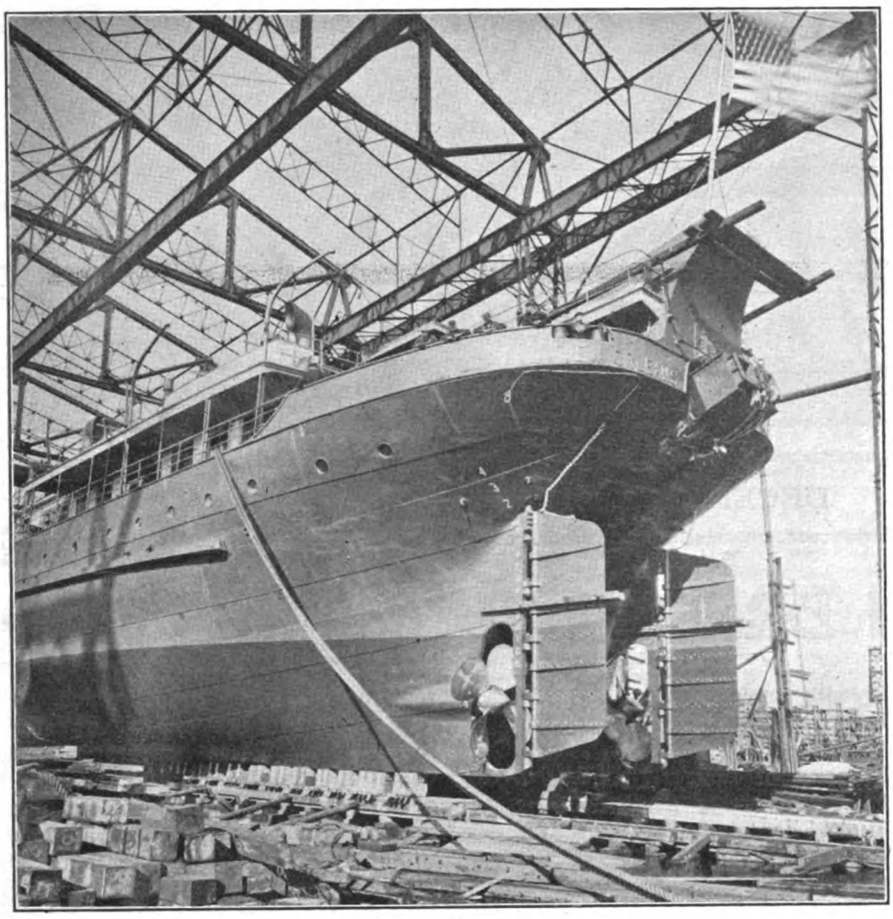

LAUNCHING OF THE DREDGE NEW ORLEANS AT FORE RIVER

the dredging pumps, steam being supplied by four Babcock & Wilcox Co.'s boilers.

The New Orleans furnishes comfortable and commodious quarters for its crew. The captain, inspector and first mate are berthed in a large deck house, while the chief engineer and his assistants have been accommodated in the after deck house and adjoining the engine room. The after deck house is also arranged for stewards, cooks, etc., and provided with suitably furnished mess rooms for officers and petty officers, together with toilets, wash places, etc. On the lower deck aft on each side of the well are mess rooms for seamen and firemen, cold storage rooms and refrigerating machinery. The monkey forecastle is divided off into quarters for seamen, firemen, oilers, storerooms, wash places, carpenters' workshop, etc., while nearby are located the quartermaster and boatswain. As the New Orleans will operate mostly in semi-tropical waters, the greatest attention has been paid to the sanitary and ventilation arrangements, and all living quarters and machinery places are well supplied with both artificial and mechanical ventilation.

In addition the vessel is lighted throughout by electricity and is fitted with a very powerful searchlight and a steam heating system is installed with individually operated radiators in every living room on the vessel.

Dry Dock at Puget Sound Navy Yard

Seattle, Nov. 30. — Following the visit, this month, of President W. H. Taft to the Puget Sound navy yard, comes the announcement from Secretary of the Navy George von L. Meyer that in his coming annual message to congress, he will recommend an appropriation for the construction of a third dry dock at the Puget Sound yard. Should this be authorized, this dock will be 1,000 feet in length and capable of docking any vessel likely to be constructed within the next 25 years. It will make the Puget Sound yard the most important on the Pacific coast and one of the largest of its kind in the world.

To Congressman W. E. Humphrey, champion of the American merchant marine in congress, and equally a friend of the navy, belongs much of the credit for the importance of the local navy yard. Congressman Humphrey secured the appropriation for the second dry dock now under construction and in his campaign for a larger fleet of navy vessels for the Pacific station, he began a movement for the third and largest dock. Should he succeed and Secretary Meyer's recommendation be approved, there will be no excuse that the navy department can offer for leaving the Pacific coast inadequately protected as it has been for years. Heretofore, the department has refused to station a proportionate number of war vessels on this side on the ground that the docking facilities were inadequate.

In a recent letter to Congressman Humphrey, the latter was assured by Secretary Meyer that he will recommend in his report the construction of a third dry dock. Mr. Meyer was here last year and inspected the local yard, while undoubtedly the visit of the president early this month had some influence on the department's decision to approve the suggestion to give the Puget Sound yard greater docking capacity.

The accompanying photograph gives a general idea of the progress being made on dry dock No. 2. Earth was first turned for this improvement two years and seven months ago and it is expected to be ready to turn over to the department late next spring. Its great size is apparent by comparison with No. 1, which is shown to the right. The contract is held by the Erickson Construction Co., of Seattle, which is proceeding as rapidly as possible. Some time ago there was an incipient strike among the stone cutters and this delayed the work to some extent. Aside from this, there has been no difficulty with the workmen. After the contract was begun, excavation proceeded by means of huge steam shovels until February of last year, when the department halted operations while the question of widening the dock was under discussion. This matter was finally determined and in July of last year the contractors resumed and since then there has been no interruption.

The dock will be 863 ft. over all with a width of 156 ft. over all. Originally the width was 146 ft. over all, but this was increased to conform with the locks of the Panama canal. On the floor inside the caisson the dock will measure 788 ft. while the inside width will be 110 ft., the same width as the locks of the canal. Thus any vessel that can pass through the Panama ditch will be able to dock in the new dock. At present it is about 76 per cent completed.

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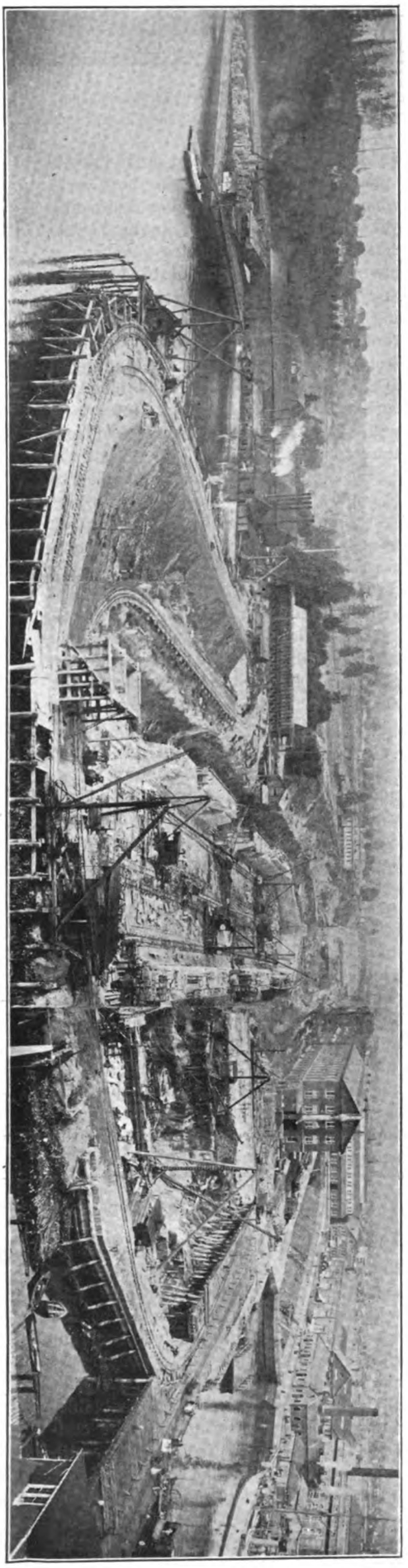

SHOWING PROGRESS OF WORK UPON DRY DOCK NO. 2 AT THE PUGET SOUND NAVY YARD

In excavating for the dock, the contractors will have turned over close to 1,000,000 cu. yds. of earth by the time they complete their contract. The rear of the dock extends into a hill, part of which had to be cut away. From the top of this elevation it is 90 ft. to the bottom of the dock, which also is 65 ft. below the general level. In excavating for the dock, various strata of hardpan, sand and gravel were encountered. Considerable water was struck and this for a time greatly hampered operations. Finally it was found necessary to install two 10-inch pumps to carry off the flow. A system of draining pipes was laid below the floor level and when the first concrete was laid in August of last year, the ground was dry and in good condition for the concrete. Of this, nearly 100,000 cu. yds. were used in the floor alone, which is 17 ft. in thickness along the middle, tapering to 12 ft. along the edges. Like the sides, the floor is of concrete, reinforced by granite, giving the dock the greatest possible strength and stability. The granite is being brought from the fine quarries at Index, Wash., and already about 250,000 cu. ft. of this stone have been utilized.

In the photograph is shown the great coffer dam which has been thrown up around the dock excavation, the gravel from the excavation being used for the coffer dam. When the dock is completed, this will be dredged away. On the right of the dock, will be installed the pumping plant. On the opposite side it is expected that the seawall will be extended and the material used in erecting the coffer dam, 100 ft. in width, will be utilized to fill up the low land lying on either side of the new dock.

The pumping plant is to be electrically operated, but the contract for this and for the immense caisson are not included in that held by the Erickson company. The Moran company, of this city, is constructing the caisson at its big plant here, and this will be ready in time. It will be launched next month.

The location of dock No. 2 is just west of No. 1, and in addition to these two, there is ample space for the third which Secretary Meyer will recommend. The original appropriation for No. 2 was $1,800,000, but owing to the widening of the dock, an additional $250,000 was added. At mean high water this dock will have 38 ft. of water over the sills, more than sufficient to float the largest vessels of the day.

Comparison of No. 1 and No. 2 docks in the photograph gives an idea of the great difference in their sizes. The original dock's dimensions are: Length over all, 650 ft.; on floor, 619 ft.; width of entrance, 93 ft.; depth over sill, 38 ft.

The Naval Strength of Italy and Turkey

Commenting on the comparative naval strength of Italy and Turkey, *The Shipbuilder*, Newcastle-on-Tyne, points out that the former, which comes sixth on the list of the world's great naval powers, in other words, after Great Britain, Germany, the United States, Japan and France, at the outbreak of hostilities possessed 11 completed battleships, 10 armored cruisers, six third-class cruisers, two torpedo cruisers, five torpedo gunboats, one gun vessel, 25 torpedo-boat destroyers, 36 first-class and 12 second-class torpedo boats, and several submarines. All her 21 armored ships have been completed since 1888, and the greater number of them have 12-inch or 10-inch guns as their main armament. Most of the guns carried by Italian warships are of the Elswick model, and differ little from British ordnance. The third-class and torpedo cruisers, torpedo gunboats and gun vessels have also been completed since 1888, and three of them since 1900. All the larger vessels and most of the destroyers and torpedo boats have been built in Italy.

Turkey, when war was declared, had three battleships, one cruiser-battleship, two fast protected cruisers, four torpedo cruisers, one gun vessel, ten destroyers, and about 19 torpedo boats which are described as first class. Two of the battleships, purchased recently from the German government, were completed in 1893 and 1894, respectively, and both are armed with six 11-inch guns. The other battleship was built in 1876 by the Thames Ironworks Co., and reconstructed at Genoa in 1901; while the cruiser-battleship was built at La Seyne, in 1870, and reconstructed in 1906. The protected and torpedo cruisers and the gun vessel date from 1891 to 1907; three having been built at Kiel, two in Turkey, one at Elswick, and one at Philadelphia. These figures, of course, do not include the ships building for either belligerents. Italy's first Dreadnought battleship —the Dante Alighieri, which will mount 12 12-inch guns—will not be completed until next year.

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NAVAL ARCHITECTS AND MARINE ENGINEERS

THE nineteenth annual meeting of the Society of Naval Architects and Marine Engineers was held in the rooms of the society, Engineering Societies building, No. 29 West Thirty-ninth street, New York, on Nov. 16 and 17. Due largely undoubtedly to the fact that the John Fritz medal was to be presented to Sir William Henry White for notable achievements in naval architecture the attendance was the largest on record. It has been seven years since Sir William visited the United States and the homage which was paid him by members of the society was both hearty and spontaneous. President Stevenson Taylor presided.

The annual report of the secretary-treasurer indicated the society to be in excellent financial condition. Its total revenues are $24,091.36 and its liabilities none, while its membership has increased from 766 to 783.

The members rose while the death roll was read as follows: William H. Allerdice, Alexander E. Brown, Jarvis B. Edson, James J. Killilea, William Rowland, Calvin B. Orcutt, Walter L. Pierce, Howard Wood.

The following were elected as members of council for the term expiring Dec. 31, 1914: C. H. Peabody, F. L. Dubosque, H. E. Sadler, D. H. Cox, R. M. Watt and H. L. Ferguson. H. L. Aldrich and A. P. Niblack were elected as associate members of council and Harvey D. Goulder was elected to fill the vacancy caused by the death of Calvin B. Orcutt.

Greatly to the regret of the society Naval Constructor W. J. Baxter declined to stand for re-election as secretary-treasurer, owing to ill health, and D. H. Cox was elected in his place. Later the society adopted resolutions in recognition of Mr. Baxter's service, as his retirement from official connection with the society was acutely felt by all of them.

At the invitation of President Taylor Sir William Henry White and Admiral F. J. Bowler took seats upon the platform. President Taylor's annual address was as follows:

President Taylor's Address.

"As you will have already observed the papers to be read and discussed at this nineteenth meeting of the Society of Naval Architects and Marine Engineers are unusually numerous and unusually interesting, so much so that the two days alloted to our meeting will be all too brief for the consideration deserved. You will, therefore, be pleased by my prevailing thought at this moment that brevity is the soul of discourse as well as of wit. You will note on reading the report of the acting secretary-treasurer that the condition of the society in membership and finances is quite satisfactory. There is an increase in membership over 1910 of 16 and at this meeting there will be added in all classes 27, making a total register of 810,—notwithstanding several resignations of juniors who would not accept the conditions of the amendment to the by-laws last year compelling qualified juniors who have reached the age of twenty-six years to accept the option of being transferred to active or associate membership, the additional cost of which would be the difference in dues, namely $4.00 per annum.

"I desire again to call your attention to the advantages of life membership, addition to which strengthens our finances.

Our Merchant Marine.

"Concerning the one subject that probably is nearer to us as naval architects and marine engineers than any other—that of the American merchant marine—I have but little to say. We seem to be no nearer the establishment of such service between this and foreign countries than we were a year ago, and we will be no nearer so long as the friends of such enterprise have so many remedies for the situation. I still believe that some time the many views now held by those who would advance the prospects of our merchant marine will be modified in such a way that finally there will be a concentration on one idea so supported by public opinion that the desired result will be attained.

"There have been published various reports of exceeding activity in our ship yards which to the ordinary reader would indicate that there is no need of any legislation assisting the promotion of the merchant marine. Inquiries were made of all of the large ship yards on the great lakes and Atlantic seaboard and without taking into account the inland river steamers, tugs and barges, there were found to be in the twelve main ship yards of the lakes and Atlantic 33 vessels for the United States government having a displacement of 167,200 tons, and five for other governments having a displacement of about 60,200 tons; and for coastwise merchant freight service 13 steamers having an approximate displacement of 80,000 tons. Excepting through interviews with those in authority published from time to time I do not know what the future policy of the government as to the navy may be, but if that support be taken from our ship yards, the figures given before show a very moderate amount of work indeed for so many plants, valuable in the funds expended therein and in the great ability of their designers and executive forces. Advocate as I am of a supreme navy I still more advocate the need of a large and important merchane marine.

"I note with pleasure in the replies made to the inquiries before mentioned the hopeful spirit which prevails as to the future and I quote from one with emphasis: 'It is time that some action should be taken on the part of the United States government in favor of legislation which will be favorable to the American merchant marine. We have all sorts of things projected in the political arena of this country of late but the question of legislation in favor of building up the merchant marine should enter largely into our politics and be made a paramount issue. No healthier political agitation could come to this country and result in greater benefit to the people of the United States.'

Completion of Panama Canal.

"The completion of the Panama canal is expected to increase the demand for coastwise steamships and without any doubt this should be the case, but we insist that all inherent rights of the United States people who are paying for this great enterprise shall be preserved and held inviolable; and that any treaty that can be conceivably construed to interfere with this position shall be abrogated. I commend to your careful consideration one of the papers on this subject which will be presented at this meeting.

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"Let me again quote from another reply what seems to be a valuable hint. 'It now looks as though the coast yards would have plenty of inquiries for vessels of good size. Let us hope that *good horse sense* will prevail so they may secure prices which will give them a profit. They certainly are entitled to it.' In other words, inject into your future competition the word 'reasonable', a valuable addition to recent legal phraseology.

"About noon on a bright clear day last July, I was crossing Spithead from South Sea to the Isle of Wight. Our little paddle steamer was held up midway and directly before us passed out to sea the great British naval fleet that had been assembled the week before for review by the newly crowned king, George V. I had seen the coronation processions in London and had been deeply impressed by the stately dignified ceremonials. They made me feel as though there had passed before my eyes the historical events of centuries; but I had missed the great royal naval review, prominent in which our own flag had been gallantly borne by the Delaware. The royal review was of battleships, cruisers, and other men-of-war at anchor, gayly decorated for the occasion and indeed it must have been a grand sight. But to me on the little paddle boat, this same naval fleet proceeding to sea practically in double column, ready for business, moving forward with solemn resistless force presented a far more effective sight than when dressed in gala array at anchor.

British Naval Display.

"When the last ship had passed, there stretched within our vision a huge gray crescent of men-of-war nearly fifteen miles long. Such a display of majesty and power combined I had never before witnessed and the thought came—what destruction, what carnage would be possible were this great fleet to be assembled, say off Sandy Hook, with hostile intent.

"To relieve your minds let me say that not for one infinitesimal part of time did I fear the ultimate outcome; but the thought of the immediate possible outcome was appalling.

"A few days ago, our own naval fleet was anchored for several miles along our peaceful Hudson; and they in turn passed out to sea under review of the president of the United States and they looked good to me. I am proud of our navy and proud of the Society of Naval Architects and Marine Engineers upon whose roll are numbered those who are responsible for the design and construction of this magnificent fleet.

"Possibly, indeed I may say probably, the much desired principle of arbitration will do away with the need of these monster fleets but as I gazed at our fleet sailing down New York bay and I recalled the sailing of the great British fleet out into the English channel it seemed to me that combined for right and justice backed by the respective governments they would form an unconquerable power for peace throughout the world.

"This society was invited by the Institution of Naval Architects (of Great Britain) to be present in 1910 at its Jubillee Meeting celebrating the fiftieth anniversary of its incorporation.

"You will remember that the lamented death of King Edward VII caused this event to be postponed until this year when the invitation was renewed.

Institution of Naval Architects.

"About 25 of your officers and members were fortunate enough to accept the kind invitation and to be present at the mettings and attendant festivities commencing July 3 with a preliminary reception by the president of the institution, the Most Honorable the Marquis of Bristol, R. N., Lady Bristol and the council followed by the formal opening of the meeting by the honorary president, H. R. H. the Duke of Connaught and finishing at the end of the week with a visit to Windsor Castle by command of his majesty the king.

"From beginning to the end of this jubilee there was a splendid program conceived with infinite courtesy and care for the pleasure of all and executed with admirable precision.

"Besides the special entertainments prepared by the institution there were notable receptions by his majesty's government, by Lord and Lady Brassey, by the American ambassador and Mrs. Whitelaw Reid and by Lloyds Registry of British and Foreign Shipping.

"Altogether it was a memorable occasion never to be forgotten by those who participated.

"It is with special gratification that we note the presence at this meeting of our distinguished honorary member, Sir William Henry White, formerly, for years, the naval constructor in chief of the British empire. He is responsible for many super-excellent designs of the war vessels of the British navy and some of those of other navies, as well as for the fastest merchant vessel in the world, the almost perfect performance of which will be mentioned today in his paper.

"Under his guidance some of our own naval constructors, at the beginning of our new navy, obtained their special education. To him many engineers, civil, mechanical and naval are greatly indebted for innumerable courtesies in his own land.

"He had received abroad and in this country many well deserved honors and has now again come to receive the John Fritz medal bestowed upon him by its board of award for his notable achievements in naval architecture.

"In your behalf I bid him thrice welcome and tender our best wishes for a long continuance of a busy and useful life."

John Fritz Medal.

The John Fritz medal was presented to Sir William at the annual dinner, which was held in the grand ball room of the Waldorf Astoria on Friday night. John Fritz himself was present and the scene presented was a memorable one. The medal was presented by Onward Bates, of the John Fritz medal board of award. Sir William's reply was a lesson in the art of public speaking to everyone present. Not once did he raise his voice and yet he could be heard in the furthest reaches of the hall. Emphasis was by intonation and not by gesture. No better example of public speaking has ever been heard before the society and everyone was deeply moved by Sir William's reply. His tribute to John Fritz was touching and in endeavoring to articulate his reply John Fritz broke down. Nearly 500 persons, many of them distinguished in mechanical, civil and electrical engineering, attended the dinner.

Among those attending were: James G. Winship, H. I. Cone, J. W. Sterling, Lewis B. McBride, J. B. Howell, Ernest H. B. Anderson, J. E. Denton, L. H. McMurtrie, Frederic W. Baker, Eugene R. Pommer, H. L. Des Anges, J. B. Grabe, R. A. Sheerin, Alfred V. S. Olcott, L. Katzenstein, Thomas I. Miller, G. H. Bull, C. H. Retzmann, Walter Anoker, Harry G. Skinner, James W. Lee, W. H. Fletcher, Elliott Snow, F. L. Fernald, Harold A. Everett, Harold P. Norton, F. T. Bowles, S. Inglis Leslie, Herbert C. Sadler, Albert Norris, W. Newman, John G. Kreer, Commander T. Hiraga, H. H. Brown, J. F. Tams, W. Hovgaard, John Hyslop, C. H. Peabody, W. M. McFarland, Darwin Almy, E. P. Bates, T. E. Crossman, J. W. Waters, John Platt, A. W.

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Thompson, Charles W. Buckelaw, W. L. Capps, J. H. Higgins, John M. Blankenship, H. D. Gregory, J. W. Burnham, C. E. Burney, Wm. Binley Jr., A. J. Maclean, S. K. Smith, Gilbert C. Dohen, Norman C. Wiley, C. L. Ginch, James Donald, Harvey D. Goulder, A. George Matteson, Ernest H. Rigg, J. R. Andrews, R. Stocker, George A. Colley, F. Carlson, Wm. V. Featherby, B. R. Smith, George H. Richey, George E. Weed, George W. Magee, E. A. Magee, G. K. Bradfield, W. D. Hoxie, Andrew Fletcher.

On the Maximum Dimensions of Ships

THE first paper read was Sir William Henry White's "On the Maximum Dimensions of Ships." Sir William read the paper himself, saying:

"Before I read this paper in abstract I should like to have the opportunity of thanking the society for the great honor that was done me many years ago in electing me an honorary member. Not long after the action was taken, my health broke down under the stress of work, but the kindness that was shown me by the president and members of this society, the president at that time being my friend and former pupil, Admiral Bowles, I shall never forget.

"This is the first time that I have been able to attend a meeting of the society, and I wish to take the opportunity, sir, of saying in my own words what I have written many years ago, that I am and ever shall remain your grateful debtor.

"I think it will be for the convenience of the meeting, as this paper has been written simply to provoke discussion, if I simply indicate its principal points as I go along, in order to save time, and do not attempt to read the paper in extenso. I should explain that it was written under very difficult circumstances, mainly in mid-Atlantic, and in weather when the only means I had of writing was to use a pencil, because the movements of the ship were so violent. It was revised in Winnipeg a few days ago, and if there are any traces of haste in its composition, I hope you will excuse them because of the circumstances under which the paper was prepared."

He then presented the paper in abstract, making the following comments, which do not appear in the paper:

Sir William's Comments.

In Par. I, after "Always will be promoted by increased dimensions:"—That is, when the ships are under way; people often forget that a large part of the time of service of ships is spent in port, and not under way. That is a point to which I draw attention later on.

Now in Par. II, after the words "and 20 exceeded 15,000 tons:"—Now, facts of that nature are not recognized in these discussions as a rule, and they require to be.

Also in Par. II, after "Similarly influenced all mercantile marines:"—I need not trouble you with the facts, but I have got them here, and they can be found in any statistical statements of shipping.

In Par. III, after "Were not improved upon:"—I can remember the time when we were up against the difficulty of increasing the dimensions. As a boy at Devenport I have been on board the Orlando school frigate, of 300 tons, wood built, but it could not be run. The attachment of the stern to the rudder post and stern post were continually breaking, and the ship herself would not keep her form. Well, now, that condition of things no longer affects us as naval architects. I am not saying a word against building bigger ships if you can make it profitable; but today we are not arguing the commercial side of ship building, but the commercial side of ship owning.

Cannot Load to Draught.

In Par. IV, after the words "Has been relatively small:" I can leave that, and need not say a word to this assemblage about what the disproportionate increase is in this matter. As matters stand, many of the larger ships cannot load to the draught to which they are capable of being laden safely, and a singular result of that is that when one sees statistical statements of ships, displacements for ships are given which are only obtainable if the ships are taken out into mid-Atlantic and laden there. You will see that the displacements do not at all correspond to the working conditions, and very often that has led the layman into very singular conclusions. I remember one case in which the president of a great English engineering society named the length, breadth and depth of a ship, and associated these dimensions with a displacement which was greater than the ship would have had, because he was told the Plimso was so much, that is, if she was laden down to 40 feet, but if the ship was only laden to 30 feet the result was ridiculous, although he did not seem to see it.

After Par. VI. The Keil canal construction is a case in point. The German government is spending $55,000,000 on reconstructing the canal, not making it, but reconstructing it. Of course, the main purpose underlying this is strategical, to enable the German fleet to move from the Baltic to the North sea under an alliance. I presume the construction of the Panama canal is not altogether without relation to the strategical advantages which will result from its being open. But these are special things; they affect the whole nation, and have not to do with the considerations which affect the mercantile marine, generally considered, as a money obtaining proposition.

Limit of Draught 40 Ft.

As to the limit of depth of water likely to be reached, I am of opinion that it is very improbable that it will go below 40 ft. in most of the ports of the world. Of course, in British sea ports we have a great advantage in the considerable rise of tide, so that the statements which are given in the paper, as to actual depth, must be associated with that circumstance, that at high water we enjoy a much greater depth than would be true in most cases in other parts of the world.

In clause VII. I point out these decisions evidenced in great permanent work to represent the conclusions reached by the various authorities after conference with those who are supposed to have the right to give an opinion as to the probable increase in dimensions during, say, the next quarter of a century. I have been myself personally consulted by many of these great authorities and have had something to say about the conditions which have been given effect to in the work. Approach channels are being built in the same way.

In Par. IX. After "caution is required:"—I dare say some of you have seen what may happen with an almost imperceptible velocity of approach, when one of these great ships strikes against some other ship or the wharf. We have had cases in England where attempts to get these long ships into the dock entrances, under tidal conditions which were un-

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favorable to the ship. In one case the Mauretania was being taken into an entrance on the Mersey, and her stern was in a current moving in one direction, and her bow was in an eddy moving in another direction. When you stretch over 800 to 900 feet, that may easily happen as you approach the shore, and it is not a negligible condition at all. You cannot have these huge ships, which must be moved very slowly in those conditions, without having considerable risk and the need of great caution. And then that is not all—you must have in connection with ships of three dimensions the occupancy of a great space or the freedom for them to move in a great area which detracts from the use by other ships of these areas and in most harbors of the world that is not a negligible quantity.

Most Useful Size of Ship.

In Par. X. After "extended widely:" Coming through to Montreal I had the good fortune to travel with one of the greatest English ship owners, interested in all classes of ships. I said to him:—Taking things as they are at the present time, what do you consider to be the most useful size of ship, and what do you think is the upper limit of draught of water?" His answer was, and you may be interested in hearing it—I have not stated it in the paper—"About 7,000 tons dead weight cargo capacity and about 24 ft. laden draughts of water." From the point of view I have just mentioned, this appears to me about right.

In Par. X. After "is frequently 4 to 5 feet:"—I saw, myself, at the review at Spithead, to which the president referred in his opening address, vessels whose normal draught of water in all the tables was 26 to 27 feet, and they were drawing 31 ft. I took the draught myself, and there is no doubt about it.

Now it is a very singular thing to me, and perhaps by bringing up this point we shall get some information—I am always anxious to get information—that some years ago the warships of the United States navy were always of relatively shallow draught. I think Admiral Bowles found that not altogether a comfortable condition himself, but it was imposed upon him as essential to the service, and was accepted. I notice in the modern warships of the U. S. navy the draught has been very much increased, and no doubt there is good reason for it, and if we could hear why the change has been made, it would no doubt be very interesting.

Cannot Enter Naval Bases.

I may tell you that there are some harbors which have been made as naval bases into which many British ships cannot go. I have been in these harbors myself. There are places where the ships, when laden, cannot take shelter, although these harbors were constructed at enormous cost for the purpose of sheltering the ships. I say that is not business. One must regard this question of warship construction from the standpoint not merely of the harbor, but of the place of shelter and naval bases, and harbors of the world, and I think that is a consideration which will have its effect whenever war happens, which, I pray God most earnestly may not happen, but if it does happen, these ships of great draught will necessarily have their field of operation restricted and their ports of shelter and repair will vanish. It is impossible that it can be otherwise.

In Par. XI. After "due to larger size in passenger steamships:"—And there is a very real thing, although it does not seem very reasonable, and that is the attraction for many people in going in the biggest ships afloat. The biggest, as you know, is not always an attraction for a certain class of men. Now, in regard to the maintenance of speed in rough water, what I have on other occasions pointed out and what seems to me to be the paramount consideration in this matter, is that the maintenance of speed at sea is a matter dependent upon the relative size of the ship and the waves, and particularly their length, and it is a very singular thing how little regard has been had to the consideration to which I draw attention in the paper, that although the ships have got bigger, there is no reason why the waves have got bigger. The waves of the Atlantic are what Dr. Scoresby discovered them to be sixty or seventy years ago. The facts which I put together more than thirty years ago in my "Manual of Naval Architecture" in regard to ocean waves are substantially accepted after the most thorough examination in recent years, and now it has gone out of the domain of personal opinion, and I invite your attention to the detailed statement which I have made at the bottom of page 10 and top of page 11 of my paper, as to the actual performance of the Mauretania, a ship in which I have some personal interest, through her years of service. I will not attempt to read it, and will simply give it to you for reading, and if after reading that, if any one will assert that for the purpose of securing regularity of trans-Atlantic passage it is necessary to make bigger ships, I cannot argue with that man,—I must leave him alone—I cannot say any more, but it seems to me the argument in this paper is unanswerable.

Driving a Ship at Sea.

Now we come to a consideration which is also often overlooked, although it applies to all classes of ships—the limits of the speed at which you can drive a ship at sea is not, in any one class of ship, from the torpedo boat destroyer up to the Mauretania, determined by the size of the ship, but it is determined by the element of the danger of having the navigating position or the fittings destroyed by the blows of the sea if the vessels are driven at high rate of speed through heavy seas. This matter was forced on my attention nearly 20 years ago in the days when I designed the first torpedo boat destroyers. Then we found that the cry for higher speeds, which we were always getting from civilians, but not from the men in the destroyers, was a fallacy, because you could not utilize the speed one day out of ten, even in the English channel. Sometimes, in the lightest summer breeze in the English channel, you had not the power to utilize that speed. It was only in the smoothest water that the speed could be utilized. On board the Lusitania, going home last year, the captain of that ship, a most experienced officer, said to me: "I have learned one thing since I have been captain of this ship that I had not realized before in the same way. I can drive this ship; she never needs to be stopped in any sea, but it is not worth doing when we get a green sea up at the navigating station and it looks as if the pilot house would be blown away." That is a fact, that in the navigating of ships of any size, there must come a time when the captain, if he is a sensible, wise man, will not incur the risk which comes from driving a ship hard against a heavy sea. We have people who think if you make ships a thousand feet long that would disappear, but nothing of the kind would happen. The experienced seaman will confirm what I say as to the behavior of ships, and what I have stated on the lower half of page 11 are confirmed by the facts. You need not make a ship large to have her steady. One of the steadiest ships I have been aboard of was the cruiser Inconstant, although she was under 6,000 tons displace-

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ment. I have been in the Bay of Biscay on board a passenger steamer of only 10,000 tons that, when we had waves 30 feet from hollow to crest, coming broad side, did not roll two degrees either side of the vessel. It is not size, as we know, that makes a ship steady.

Warships as Gun Platforms.

You know, some of you, as well as I do, that some of the largest warships in the world are the least steady gun platforms. I will not dwell on it, but that is a fact. If they have been made stiff, for other reasons, and give short periods, even in the ordinary conditions of seaway, these ships will not be so steady as gun platforms as ships which have longer periods. From that point, mere size is not necessary to good behavior.

In paragraph XII. After "likely to be built:"—Then I give the facts as to the cost of trans-Atlantic steamers from 1874 onward, with which I need not trouble you. I also give a summary of what was said a few years ago by a special committee appointed by the British government to consider the question of subventing the fast cruisers, and of the action which was taken by the British government, with the approval of parliament, when the Lusitania and the Mauretania were built.

Earning Dividends.

Now, what have we got to? We have got to this, that according to the best information published—of course the actual cost of these recent ships has not been stated. I know what the cost of the Mauretania was, but I am not going to tell you —you would not expect me to tell you. As regards the Olympic, those who ought to know have said, in connection with the discussion as to the harbor dues to be charged upon these ships at Southampton, that the Olympic represents $7,500,000. Well, we may take it that $7,500,000 is about the cost of either the Mauretania or the Olympic. Then there are ships built, the particulars of which I have given in the table, and there are other ships building which will probably cost about $8,750,000. The question is—what is the chance of these vessels earning a dividend? Well, I am not so foolish as an outsider to say anything about the decisions which have been reached by gentlemen of great experience in commercial life who have decided to build these ships. They have been governed, no doubt, by the considerations that on the whole it is the right thing for them to do to have the largest ships, only they have not gone in, too, for the fastest ships also. There has been a limitation in the speed and power of the ships as compared with the Lusitania and Mauretania. The Olympic has made, as you know, a sea speed of about 21 knots, average, across the Atlantic. The average for the Mauretania is 25.5 knots, and 4.5 knots represents some considerable advantage in speed. The new German ships are to be 22 knots, and the Aquatic, of the Cunard line, is to be 23 knots.

Time Spent in Port.

I would like to allude to one matter I have treated at length in the paper that seems to be of great importance. These recent types, particularly the Olympic and the Titanic, are really the latest developments of the intermediate type of trans-Atlantic steamer in which great passenger accommodation is associated with large dead weight cargo capacity, and the point that is in my mind, as of enormous importance in connection with these ships when they reach the capital cost equal to that of which I have spoken, is as to what will be the net result if an attempt were made to utilize that cargo capacity, because it was perfectly obvious that with that great capital expenditure a quick turn round in port is essential to commercial success. It is equally obvious that if a huge amount of dead weight cargo is to be got on at the port of departure and discharged at the terminal port, that it will be bound to remain in port longer, considerably longer, than would be necessary simply if you were dealing with a passenger ship. As to that quick turn around, I dare say many of you know that the time, the schedule, of the Mauretania was varied after the beginning of the trips of these ships, in order to spend less time in port. It is true probably of all transportation, that the means of transportation must be at least as full as possible and as quick as possible, and if you increase the periods during which it is non-productive, not earning, because you are simply engaged in getting in and out of the ship the things that have been carried, that must affect the net result. My view is, if high speed is to be obtained, knowing what we do now, knowing about what size of ship will give you regularity of passage on the Atlantic, that it is possible that the best results will be obtained by the construction of what are called express steamers for passenger service. We shall see whether the passengers think the advantage of very quick traverse of the Atlantic in these passenger ships is to be set off against the other things which may be obtained in the other ships.

Question of Warships.

Now, I must leave the merchant ships and go to the warships. A reference to the warships is contained in the second clause of page 14 and afterwards. I have recapitulated what I said last year in my paper which was read before this society on "Notes on the Armament of Battleships." I do not know that I need go over this ground again, but my critics, of whom I hope there will be many, can use these statements of mine, which have been set down in quite cold blood, and hold me responsible for them. Therefore, I will not recapitulate them. There they stand. I may be wrong, but it is what I believed to be the case, and it is the doctrine I am prepared to maintain against all comers to the best of my ability.

I will now take up the paragraph on page 17, beginning "My personal convictions".

Sir William Henry White then completed the reading of the paper as printed, and the paper, at its conclusion, was received with loud applause.

The President: I am quite sure you have all enjoyed this paper, and I take great pleasure now in calling on Past President Bowles to have his say.

Comments of Admiral Bowles.

Past-President Bowles: Mr. President and gentlemen, I will take my little note book and descend into the arena. (Laughter.) As one of his first American pupils and possibly his oldest pupil here present, it is a great satisfaction to me to express the cordial appreciation of this society of the distinguished author of this paper.

It is a great pleasure to those of us who are present and an honor to the society, that such a very old question as the maximum dimensions of ships, and at the same time such an ever new and present problem, should be presented to us in such a masterly way. The paper to me discloses throughout, perhaps unconsciously, the attitude of the naval architect in the problem that is always presented to us, of accomplishing the results of a design on the least dimensions, and therefore it might not be disrespectful to change the title of this paper to "The Mini-

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mum Dimensions of the Maximum Ship".

The author has stated in the beginning the pertinent questions on the subject and appears to have satisfactorily answered them himself. In answer to his first question, "Is it probable that the dimensions of ships will continue to grow at the rapid rate which has prevailed in recent years?" he is inclined to answer No, but he admits that the dimensions of the average merchant vessel will probably continue to increase, and the reasons which he gives are capable of reinforcement, because it depends largely upon the development of terminals for commerce. Now, there is throughout the world a remarkable activity in the development of steamship terminals, not only in the United States, but throughout the world, which will have undoubtedly a profound influence in this respect, and, as the author states, a beneficial one.

In answer to his second question, "Will an upper limit to the sizes of ships be reached?" he admits that this question does not depend upon the naval architect, but upon the conditions of terminals and financial considerations.

Now, in approaching the discussion of his questions and the considerations which he advances which are likely to determine such limits for either merchant or war vessels, he discloses some matters of opinion to which I venture to call attention.

Abandonment of Light Draught.

He asks for some explanation of why the United States has abandoned as a feature of its battleship design a moderate draught of water. Possibly, it is not becoming in me to attempt to furnish the answer to that question, but having grown up with the new navy I am inclined to try it. When we started out in 1882 to build a new navy in the United States the people of this country regarded the naval force as one solely for defense, and it was with the greatest reluctance that congress approached the idea of building a battleship, and then Mr. Nixon was limited in the scope of his design by the necessity of calling it and making it a coast defense ship. That original condition continued until the people of the United States realized that we had grown to a different situation amongst the nations of the world, so that when the head of one of the foreign navies asked me for the justification of the size of our battleship, saying that they were able to lay out the plan of campaign and say where battles should be fought, and so limiting the size of their ships, I replied to him that the United States was unable to locate the field of a possible battle and that it felt that its battleships must be so designed that they were capable of going anywhere and fighting when they got there.

The author first discloses his well-known position in favor of moderate dimensions b recording his opinion that the upper limit of size has been reached for the trans-Atlantic service in the Mauretania—

Sir William Expostulates.

Sir William Henry White: Excuse me, I did not say so. I said that the upper limit of size reached in the Mauretania gave you all that was wanted in the regularity of passage. That is all.

Past-President Bowles: I quote again from Sir William's paper: "I have previously recorded my opinion that this upper limit of size has been reached for the trans-Atlantic service in the Mauretania." I am reading on page 10, near the bottom of the page.

Sir William Henry White: So far as maintenance of speed is concerned. Look a little further, please.

Past-President Bowles: Now, no doubt the designers and builders and owners of the Mauretania and Lusitania, in the production of these triumphant vessels representing the acme of luxury in ocean travel, having been presented with the funds, no doubt thought not only to take the next step in trans-Atlantic naval architecture, but to skip a few of the intervening steps. Now, whether they have accomplished that or not remains to be seen. They have been answered by the construction of even greater vessels, of more moderate speed and of greater passenger accommodations.

The author of the paper under consideration has seen fit to question the earning capacity of this cargo capacity of the newer vessels. Now, I would enter on the discussion of that matter with much greater diffidence than the author refers to himself. But I approach very seriously the statement in his paper where he discusses this feature of the Olympic, intimating that a vessel of smaller dimensions, without this cargo capacity, could have been produced with equal passenger accommodations, and that leads me to remind you that the most profitable part of the traffic on a trans-Atlantic liner is the transportation of steerage passengers. They constitute a very attractive cargo, because they get on board on their own feet and they discharge themselves without the use of any elaborate machinery. They even venture fearlessly into the toils of the custom house and the emigration service and emerge therefrom in incredibly less time than any inanimate object can. (Laughter.)

Immigration Traffic.

Now, gentlemen, if we in the interests of our country shall do, as we ought to do, all that we can to regulate and reduce and distribute the immigration traffic to this country, it would have a more marked effect upon the maximum dimensions of vessels than any consideration advanced before us today.

Now, coming to the subject of maximum dimensions of battleships, I quote from page 17, as follows: "My personal conviction, based upon long-continued study of the problem, is that the wiser course in warship building would be found in a return to more moderate dimensions and a reduced unit-cost per capital ship." And again, on page 17: "With equal speed a reduction in the number of heavy guns carried in a single ship such as I advocated last year would enable considerable reductions in size and cost; and that, for a given total expenditure on the first cost of the fleet or squadron, a more formidable and flexible force could, in my judgment, be obtained, with greatly reduced risks from either gun fire, under-water attacks or magazine explosions."

That is a very interesting opinion to me, and it reminds me of a most interesting incident which occurred at a time when I occupied a position of some authority. At that time a distinguished school of advocates broke loose, headed by a most distinguished naval historian, advocating this same idea of the advantage of a greater number of small vessels. The distinguished historian wrote an elaborate memorandum for the president of the United States, setting forth his conclusions as deduced from the experience of Nelson and Howe and the development of the frigate as compared with the efficiency of the line of battleship, and I had the pleasure of discussing that matter and was able to point out, as has been done by others since, that the mobility and handiness of the modern battleship made all points of comparison between the experience of Nelson and Howe absolutely valueless. Suffice it to say that the result of the discussion which occurred at that time convinced President Roosevelt that he wanted the biggest ship, and that decided the design of the Connecticut

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and Louisiana and a considerable class of vessels following.

Fighting Capacity of Increased Dimensions.

I had the pleasure of laying before this society a very brief paper setting forth the facts and figures of the greater fighting capacity which resulted from the increase in dimensions of these battleships and armored cruisers. It is not necessary to recapitulate these figures, but they were adequately shown in the paper by Prof. Welsh before the Institution of Naval Architects this spring, in which he showed that an increase in displacement of 34 per cent and an increase in cost of 50 per cent in a battleship would result in a doubling of the effective gun power. I do not base my idea of the advantage of increased size in battleships wholly upon any rigid rule as to the amount of the broadside discharge or the caliber or number of the guns.

I wish to introduce into this subject considerations which I have never seen before advanced at all, and that is, that comparing a small battleship with a large battleship the efficiency of each gun on the large battleship is enormously greater from a variety of conditions. In the first place, in a small battleship everything is more or less close together, all the turrets are necessarily near the machinery, or the magazines are necessarily more or less near the heated parts of the ship. If the dimensions are too small, it is impossible to obtain any effective protection against submarine attacks, and the seaworthiness of the vessel is less. Of course, it is possible to produce similar rolling conditions in smaller ships, but stability, rolling conditions in a seaway do not constitute seaworthiness. They are a very small fraction of it.

Human Element of Efficiency.

Now, in the larger vessel, in addition to these features which I have described, there is a human element of efficiency which affects every gun compared to the smaller ship. In the first place, in the large ship there are greater safeguards with regard to the supply of power, the supply of ammunition and the supply of every essential element that goes to the gun. In the next place, there is a very much greater crew, a very much greater complement of officers, and there is this inevitable human fact, that the best people are brought up on the best ships.

Now, these considerations which I have only advanced to you in the most brief outline are those which, in my judgment, influence the wisest naval officers and the wisest seagoing officers always to vote for the biggest ship. Admiral Bacon said that the bigger the ship becomes the less vulnerable she is. I say that in the biggest ship the human element of efficiency adds enormously to the power of every gun.

The President: Mr. Nixon, may we hear from you in discussion of this paper?

Discussion by Lewis Nixon.

Lewis Nixon: Mr. Chairman and gentlemen, I share with Admiral Bowles in the pleasure we have all had in hearing this most excellent paper by so eminent an author. His reputation in the world as a naval architect gives to it a great weight. I may say that in reading it I find splendid arguments for increased dimensions.

Admiral Bowles has gone into some of the technical points, which affect this matter, and my desire is simply to touch upon a few of the reasons which Sir William advances as against the possible increasing dimensions.

I think the limit is not as stated in Par. III, but the power of utilizing to the fullest every ton of displacement you have. Size I consider a complement only in the development of the steamship to the various uses to which it may be put. Of course, we cannot have all the ships large, and hence a good deal of this argument which covers the use of ships of the ocean would not apply, because we have the smaller ships ready to take part in this particular service.

Sir William dwells a great deal upon the question of harbors and docks. The history of our lake traffic is probably the best we can call upon to show what that means in the development of large ships. In the 80's we deepened our harbors and the approaches to 16 feet; in the 90's we increased this to 18 feet, and lately we have increased it to 21 feet. The response has been so remarkable as to be almost a miracle in the development and use of greater tonnage for carrying trade on the great lakes. We not only have done that, but last year I was in Buenos Ayres, and I find that they, too, appreciate the advantages of deeper harbors, and as fast as they can deepen them they are doing so, and the response is even greater than you would expect, in other words the commerce of the port is running away from them, and they cannot provide as fast as needed the facilities for the larger ships that are coming there.

Response to Depth.

As regards some of the shippers not possessing the necessary enterprise to deepen their harbors and docks, I will only say that those cities that show the greater enterprise will reap the greater reward, and in the course of time the other cities of this country and other countries, that see their neighbors getting ahead of them, and taking away the business which ought to go to them, will rise to the occasion and deepen the ports of their cities to suit the greater draught of vessels, if it is required by the interests of commerce.

Sir William refers to the Panama canal. I quite agree that 40 ft. seems to be the low limit for that particular canal, and it is probable that ships will want to use that draught, at least. Ships will come deep laden with coal to serve their uses that far, and then coal on the other side, and be able to use the deeper draught at the point of departure.

Moving under Power.

As regards our own harbor, I remember a few years ago coming back from England, just as we finished our new Ambrose channel, of which we were so proud. The commander of the ship told me he was going up the new channel. In going up the channel early in the morning we twice had to slow down for a little sailboat not over 16 ft. long, which, secure in its right-of-way, came coolly down the channel, when it should have taken its course in another part of the harbor. I think those who know something of the handling of commerce in this harbor must realize that the time is coming shortly when there must be a drastic regulation in favor of the great interests centered here, the merchandise of which is carried in ships of great bulk and size, that will require that no vessel shall move in the harbor of New York, or at least in the channels through which the great steamers pass, unless under power control. We must have such a regulation if we are to rise to the responsibilities of the occasion, because a sailing boat in our harbor, constructed as she is, and with our traffic as great as she is, all sailing vessels must be put in the past.

Of course, we must not assume that all vessels should be larger, because some must be.

Harbor and Dock Facilities.

The author further says: "It will not be disputed that one essential factor in framing a ship building program for any war fleet should be the consideration of the harbor and docking accommodation which will be

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available, in case of war, for the reception and repair of the largest vessels." Admiral Bowles has told you something of the history regarding our first battleships which were to be made 8,500 tons. They were made 10,500 tons, and no one was court-martialed for exceeding that particular limit. We were told these ships had to be produced on a draught of 22 feet, and we have built others, and the wisdom which has been forced upon the country by the building of these vessels has provided the necessary docks, and if the wisdom of those who control the naval policy of this country in the future calls for greater depth of battleships, you will find the people of this country will rise to the necessities of the case and give the necessary facilities for docking and repairing. The mere fact that some of the docks of today cannot take the larger ships has convinced many that nothing should stand in the way of getting the best, if the best is hindered by the necessary facilities as to docks and arrangements for repair, absent at the present time, and in my opinion they will be fully provided as the necessity occurs.

The Force of The Sea.

As regards the Mauretania and Lusitania, last November I crossed in the Mauretania, and one day we slowed down to 19 knots. I was in the chart house with the captain and inquired the reason for slowing down, and he pointed out a dent made in the thick plate in front of the chart house by a wave on the previous voyage which had struck nearly 70 feet above the water line.

Now, the author of the paper says that it is a question of regularity of passage which has been the first consideration in the production of these ships. That is true. They do make fairly regular passages, but so do smaller boats, they make regular passage, but regularity of passage is not all that we must consider. Of course, battleships are made to fight, and storms do not blow for the maximum part of the time. We may have moderate weather and perfectly calm weather, but steamships must go on their course regardless of waves or conditions, and make speed. With a great ship of the size of the Mauretania, under what was a fairly moderate gale, we had to slow down, and that is a very good index of what the naval architect must come to; in other words, if you will take the small ship of 50 years ago, or even 20 years ago, and then take the newer ships, you will not see much difference in the general appearance of these ships. If to drive ships through the water at 25 knots an hour leads to the possibility of carrying away some parts of the equipment, due to the character of its construction, or due to the shape of the ship, then let us find some means by which we shall apply to the top of the ship such elements of construction as will make it possible to drive the ship under all conditions of stress and storm, without running the risk of disaster of any kind.

Advocates the Larger Ship.

I quite agree that possibly we may have to go to a very much larger size of ship in order to do this, and it is possible that to go through what would be considered the average storm conditions of the North Atlantic sea during the month of November, and not have the speed fall below 25 knots, will require a dimension of ships of perhaps 1,500 feet in length. This was impressed on me when I made this passage to which I have referred. I know at that time, when I crossed in November, for two days there were only about ten persons in the dining room, so you can understand there was a fairly heavy sea, and yet one which I would not call a gale in any sense of the word.

Stability is not what we must arrive at so much in our ships, as Admiral Bowles has said and Sir William has said. Of course, we can get this quality in smaller ships—

Sir William White: You mean steadiness?

Mr. Nixon: Yes, steadiness. Absolute regularity of arrival and departure possibly is not so strictly necessary. It is a question of dollars and cents to which we must figure the matter in the long run, and in figuring this question of dollars and cents we must take into consideration that if we build a ship to do a certain work, and then the ship is not able to do the work from the fact that we have not deep enough harbors to dock it, that we are failing to realize the object for which the big ships were built.

The Converse of the Proposition.

Sir William makes the statement: "If ships cannot be made to pay dividends on the capital sums invested in them—after meeting working expenses and cost of upkeep, and making due allowance for insurance and depreciation—they are not likely to be built." But what about the converse of that proposition? Suppose they will meet working expenses and cost of upkeep, then does not the inference follow that we must have greater and greater ships if we can make them pay? We know perfectly well that in the history of handling freight upon the ocean, the big ships put the little ships out of business every time, but, of course, if we get these ships so big that we cannot utilize their displacement to the best advantage, that great advantage of size will not hold—

Sir William Henry White: That is my point.

Mr. Nixon: Sir Henry gives some very interesting light upon the building of the Lusitania and Mauretania to the effect that the British government has granted a loan of £2,600,000 sterling, at 2¾ per cent, to be paid in 20 years, and a practical subsidy, which would pay this amount back to the steamship company. I will not go into a discussion of that policy, but here are the two greatest ships of the world brought into competition with the carrying trade on the North Atlantic, held there by the power of the great government, and may we not hope that our legislative bodies will take from that a lesson and find a way by which we can put some ships on the ocean and then drive them fast in spite of the gales?

Attacking the Unloading Problem.

Sir William speaks of detention. It is quite true we might load boats today to such an extent that in the harbor of New York that we might unload boats and reload them and clear them, in the time during which they are being coaled. Is not that another consideration for the attention of the naval architects? Is it not a question of brains? If we are to build our boats in these large sizes, and have not brains to design methods by which we can unload them, are we not wanting in some capacity in our particular chosen profession? Go up to the lakes and see what they have done there. I saw 10,000 tons of ore loaded in a few hours. It is a question requiring study, and if that is one of the limitations, and I am only speaking of the limitations—because it would take too long a time to go into any other questions—the questions brought up by Sir William as to the regularity and size of ships, etc.,—I want to say it is a problem for us to study, and if we give it proper study we will certainly be able to meet it.

Handling Men and Hogs.

The question of handling men and handling traffic is largely the same. I recall a few years ago in Europe

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talking to some distinguished generals, and they were telling me it would take six hours to detrain an army corps. I said—"Gentlemen, I can take you to Chicago and show you where we detrain 40,000 hogs, water and pen them in one hour, and if we can do it with hogs why cannot you do it with men?" So I say that when it comes to the question of the unloading of freight that the genius and the capacity of the mechanical engineer will meet that problem, and if that is one of the barriers to the adoption of greater dimensions, and the utilization of increased cargo capacity, I want to say that I do not believe that barrier is one which should stop our progress. The last cry in handling freight, gentlemen, has not been reached by any means.

Now, as to the size of battleships. I think it is a question in battleships of probably the bigger the ship the bigger fighting power you put in, that is what you are after when you build big ships.

Sir William speaks of the multiplication of heavy gun positions in ships, and that the number of such guns carried by individual ships has necessarily involved increase of length and displacement. As long as you can place the guns to good advantage, and get away without interference, there will be practically an increase in the number of guns carried, provided it is an advantage to carry them.

Increase of Weight.

He speaks of the increase of weight due to speed. I believe that the genius of the naval engineer and marine engineer will keep pace with the needs for greater power in our ships, and we shall be able to produce the power on less and less weight, and that the increased speed will be gotten at a less and less proportionate net dead weight.

He speaks again of the dry docks as affecting the battleships, and I can only say that if that affects the possible size of the ship that we have the genius to take care of that problem in the future as we have done it in the past.

Sir William says further: "In view of the foregoing considerations, it appears to be desirable to put a limit upon the cost and size of individual warships, and the concentration of so many guns in a single ship; because a single successful blow may bring about a serious proportionate loss to a fleet by one ship being put out of action." Of course, that is the old argument of the eggs in the basket, and it is so long and so tedious and has been gone over so many times before, it is hardly necessary to refer to it, except that in the previous paragraph he says: "It cannot be questioned that the increase in length and speed of recent ships will necessitate an increase in the intervals between successive ships in the line of battle." Well, if you are going to have greater intervals, then you want your units more powerful, and it follows as a matter of course.

Intervals in Line of Battle.

Sir William Henry White: Will you kindly read that again?

Lewis Nixon: I read from page 16: "It cannot be questioned that the increase in length and speed of recent ships will necessitate an increase in the intervals between successive ships in the line of battle." I say if you are going to have greater space between the units of your fleet, it would be wise to have the units more powerful.

Sir William Henry White: That is, you increase the size again. I am speaking of speed. You have been at sea in a fleet keeping station?

Lewis Nixon: Yes.

Sir William Henry White: The point I am making is, if a fleet is in close formation and you increase the speed, you must increase the intervals of the watch.

Lewis Nixon: If we must have larger intervals, it follows the individual unit should be more powerful. If you stretch out a long thin line too much, and keep the same boats, the aggregation is not as powerful.

Sir William Henry White: I am only wishing to point out that I am dealing with one point and you are dealing with another.

Lewis Nixon: I will be glad to meet that point too. Sir William says: "My personal conviction, based upon long-continued study of the problem, is that the wiser course in warship building would be found in a return to more moderate dimensions than a reduced unit-cost for capital ships." The moderate dimensions of today may be very small for the dimensions of tomorrow, or the maximum dimensions of today may be the moderate dimensions of tomorrow. It depends on the demands we make on the naval architect.

Guns and Magazines.

As regards guns, Sir William says: "Special dangers must be incurred by the multiplication of heavy guns and of magazines placed below them." Admiral Bowles covered this point as far as the present type of guns is concerned. While I thoroughly realize the danger of attempting to prophesy, I believe that modern inventive genius is going at such rapid rates that it is a question of only a few years, which you can count on the fingers of your two hands, when the idea of hurling through space a mass of steel impelled by a gun will be as obsolete as the sling of David. There will be a change in the offensive power of ships, and that will be carried in larger and larger ships. That is the prophecy. I probably will have to be called to account for it, but I believe it is absolutely in the making at the present time.

Of course, you can make a great argument as to the tremendous disadvantage of losing one boat. Possibly when a commander gets into battle, it is wise for him to think of the possibility of the loss of his boats, but the best thing for him to think about is to disregard the possibility of loss of his own ships and think more about accomplishing the destruction of the ships of the enemy. If a great powerful ship can strike heavier blows, and do more complete work, and be more successful in sinking other ships, the fact that a vulnerable blow on the part of the enemy's ship does put out of commission the tremendous power of the big ship, is not an argument for not having the power, because you can shoot a big ship as well as a little one.

As to the waves that would impede a large ship, would not they to a greater extent impede a small one?

Examples Point to Increase of Dimensions.

I did not have an opportunity to examine the paper before coming to this meeting, and I had to study it as well as I could while it was being presented by its distinguished author. It is a paper which contains the opinions of a man whose opinion should have weight all over the world. The mere fact that some of us do not agree with him will not trouble him—

Sir William Henry White: Not in the least.

Lewis Nixon: Upon reading it, as far as I could, I believe that the examples he has presented, point absolutely to the increase in dimensions,

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not only in marine ships, but in battleships.

The President: Are there any further remarks on this paper?

Discussion by Capt. Hovgaard.

Capt. Wm. Hovgaard: The arguments of this paper are set forth in such masterly manner and the arrangement of the subject is so clear and analytical, that one cannot escape seeing the points where difference of opinion exists.

In point XI, page 11, it is stated that the limit of speed in the big Cunarders in rough weather is fixed, not by size but by considerations of local damage to fittings and navigational appliances as well as dangers to the personnel. Now it appears to me, that although any ship, however large, will have a limit of speed due to this cause, still, this limit must be higher for the larger ship, since its freeboard can be made higher and hence its weather-deck can be on a higher level. Thus, for instance, a ship twice as large as the Lusitania should be capable of going up against a certain sea at a higher speed than the Lusitania.

In regard to steadiness in a seaway, the author explains how ships of moderate size may often be more free from rolling than ships of extreme dimensions, in spite of the fact, which is likewise in the paper, page 10, that larger size, if properly utilized, is conducive to greater steadiness and better behavior at sea. The reason of this anomaly is that on account of limitations imposed by harbors and docks, the naval architects are not free to adopt the most appropriate dimensions in ships of very large size.

It will be seen that this argument against an increase in size is based, not on any intrinsic quality of the large ships, but on extraneous conditions of a temporary character. In fact, when these conditions cease to exist, by a development of the harbor facilities, the increase in size can be made beneficial to seagoing qualities. It appears, therefore, that what we should guard against, as far as this argument goes, is not increase in size in an absolute sense, but a too rapid increase in size.

Further Increase in Size Unnecessary.

Dealing first with merchant vessels, I have received the impression from this paper that the author considers a further increase in size unnecessary and on the whole improbable. I presume the author has here in mind only the near future.

Now it seems to me that an enormous increase in freight and passenger traffic is certain to take place in the future, both on the Atlantic and on the Pacific oceans, when the American continent and the East are futher developed. This growth in commerce must bring with it a corresponding growth in the entire machinery by which sea-transportation is effected.

Increase in harbor facilities may not always be profitable for the time being, but no great city, district or state can afford to be left behind in the race. Ports which do not now possess the means of improvement may find the means in years to come. On the whole, progress in this direction is likely to be steady, even if slow.

That the size of ships will grow at least as fast as the harbors and docks permit, we may perhaps conclude from past experience, having in mind the probable increase in the volume of traffic. Appliances for loading and unloading ships have been much improved in recent years, and are likely to be still further developed, so as to shorten the period of detention in port.

It seems likely to me, therefore, that in the future we shall see a very great increase in the size of merchant ships, although it may be wise at present to pause for a time until harbors and docks have been further enlarged and until commerce has developed to still greater proportions.

As regards warships, I agree with the arguments of the author pro and con larger size, but yet I do not arrive at the same conclusion. This may seem paradoxical, but is simply due to the difference in relative weight which I have attached to certain arguments.

Lessons of the Russo-Japanese War.

The author here advocates in unequivocal terms a return to smaller sizes. There can be no doubt that the size of large warships has been increased too rapidly in recent years relative to the development of docks and harbors. While in time of peace this anomaly may cause certain inconveniences, it may in time of war lead to dangerous and fatal consequences. It may not be amiss to consider for a moment the case of the Russian squadron at Port Arthur during the Russo-Japanese war. In Port Arthur was found only one dry dock, which was of too small dimensions to take the battleships, wherefore those ships had to carry out their numerous repairs of under-water damage by means of caissons, under great difficulties and with great loss of time. Moreover, the harbor entrance did not permit the fleet to pass in or out except at high tide. This fact was taken advantage of by the Japanese, who on an occasion took up a position under cover of the Laotish Shan hills, where the fire of the Russian batteries could not reach them, and at a time when the Russian fleet could not leave the harbor because it was low tide. From this position the Japanese carried out an indirect bombardment of the Russian fleet, which was lying helpless in. the harbor. It was mere luck that the Russian ships did not suffer very serious damage on this occasion.

These incidents, well known to naval men, show the danger in the too rapid growth in the size of capital ships and the advisability of making timely and more liberal provisions for dock and harbor facilities.

Influence of Panama Canal.

For the United States the Panama canal may soon come to exert a restraint on further increase in beam. Capital ships are fast approaching 100 ft. beam, which will leave a margin of only 10 per cent width in the land locks. This margin seems none too large, and a beam exceeding 100 ft. will, for this reason, hardly be considered desirable for ships of the United States navy in a near future.

It seems therefore wise to call a halt in the increase in size of capital ships for the present, but on the other hand, it appears to me undesirable to make a step back to smaller dimensions, as proposed by the author. The greatest need at present seems to me, as I pointed out before this society last year, a better protection of battleships against submarine attack and an increase in torpedo armament; in other words, a transition from the pure artillery ships to a type partly artillery and partly torpedo ship, both in point of armament and protection. Such a transition cannot take place concurrent with a reduction in displacement; on the contrary, it may be necessary even to sacrifice some of the artillery and part of the armor protection against artillery, in order to gain weight for the development of the submarine qualities without an increase in displacement.

When the construction of docks and harbors has advanced sufficiently to permit a further increase in displacement, I believe such increase

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should take place, but always in a conservative manner.

Size in Itself is Not Objectionable.

On the whole, it appears to me that this as well as other limitations to size, such as regards tactical and strategical flexibility, are only of a temporary, yielding character, being ultimately a function of time and of financial resources. The objection to "putting too many eggs in one basket" falls to the ground if the number of baskets remains the same or is increased, as was actually the case when "dreadnoughts" were introduced. Size in itself is not objectionable on this ground, but only if it entails a reduction in number. The navy of each country will here find its limit for the time being, but this limit cannot be said to be of an absolute character.

An absolute barrier to the construction of larger and larger units seems to be found only in the eventual stronger development of the submarine means of attack, in particular of the submarine vessel which may some day be capable of driving the large battleships from the ocean. In my opinion then, the development cannot move backwards, the size of large capital ships must either go on increasing, or this type must be abandoned altogether.

I may add that the above remarks refer only to navies built for ocean service. Navies built for service in more shallow water may already have reached their limit of size.

Remarks of the President.

The President: I wish to say, for your information, gentlemen, that I sent copies of this paper to the managers of the Hamburg-American line, the White Star line, the Cunard line and the North German Lloyd line. The manager of the Hamburg-American line very courteously replied that unfortunately he would be out of town and could not attend this meeting, and did not have any one in his office that could take up the discussion of this paper. The manager of the White Star line has courteously replied he would like to attend, but he would be out of town and had nobody that he could send to discuss the paper. The managers of the other two lines have not up to the present moment responded.

Now, out of compliment to the author and the importance of this paper, I have permitted the discussion to go beyond the limits of time, and I must now call the discussion closed, with the exception of an opportunity to be given to the author for reply, because I must give consideration to the authors of other papers which are to be presented. As I outlined in the few feeble remarks of the president this morning, in which I tried to hint to other speakers that brevity was much to be desired, we have a great many papers which are very interesting in character, and which we will not have time to properly discuss, or even have read, if the discussion continues to the extent it has on this paper. I will call the discussion closed. Any members who desire to add to this discussion, will please submit the same in writing. Sir William Henry White will now have an opportunity to reply.

Sir William's Reply.

Sir William Henry White: Mr. president and gentlemen, the discussion as far as it has gone has ranged over a considerable field, and certain things have been attributed to me which cannot be found in the paper. For the information of the gentlemen who have made that mistake, in attributing to me opinions which I certainly do not hold, I will say that on reference to the paper they will find that I am strictly correct in what I am saying, and I will take one cast to illustrate what I mean. Admiral Bowles quoted a sentence from the bottom of page 10, in which he made it appear that the upper limit of size I considered to be reached in the Mauretania. Well, of course, if you take a sentence away from its context, we know, even in the use of scripture how misleading the result must be, like the man who preached from the text "All men are liars" without the context, "I said in my haste," you will see how meaningless such a sentence may be, and how it will fail to represent the facts. That is exactly where we are in this case. I am not suggesting there is any intention to misrepresent the statements in the paper, but what I actually said in that case was this: "Ocean waves have not grown in size because larger ships have been built; and obviously there must be an upper limit of size, beyond which, so far as maintenance of speed is concerned, further increase in the dimensions of ships will have little or no effect upon regularity of performance of service between terminal ports. I have previously recorded my opinion that this upper limit of size has been reached for the trans-Atlantic service in the Mauretania and her sister ship, and I will now briefly state certain facts on which that opinion is based." As I say, I have previously recorded my opinion that this upper limit of size, this upper limit of size which will give regularity of passage, is demonstrated in the Mauretania. Have I made it clear? I see that Admiral Bowles is not here, but I think it is an important correction, for this reason: It would be the greatest misfortune, and to me a great disappointment, if any one in this room or any one who reads the paper thought I had used this opportunity for advertising the Mauretania. That is not my object at all. I only used the facts which have come to me from my experience with the Mauretania to illustrate the general statement. I will pass that by.

Mercantile Ship Construction.

Again, about the Olympic. Now, if any one will read the paper, they will see I am most careful to point out that I am a rank outsider, in dealing with the problem of mercantile ship construction, and that I do not pretend to be able to give even the roughest estimate of earning capacity in relation to cargo, but I stand on the fact, which everybody knows, that the great intermediate class of steamers, trading on the Atlantic, going westward almost invariably go without a full cargo—the cargo is not obtainable in that direction—but I think it is also true that in the average service of a ship she does not use her full cargo carrying capacity, although occasionally she may do so. The conclusion I was arguing for was this, and the quick turn around and doing of the unloading in such a manner as shall abridge the period spent in port, which is necessarily non- —

I will leave the other things to those who care to read the paper more carefully, to see how cautious I have been, and how these statements have been made simply for the illustration of principles.

The earning power of steerage passengers was referred to by Admiral Bowles. In my paper I simply say I am dealing with dead weight capacity, and presume the ship will be kept to dimensions which give the same passenger capacity, of all classes, and the question of high policy as to whether immigration into the United States should be permitted, an Englishman, like myself,

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would not dare even think about, much less express an opinion.

Mr. Nixon's 1,500 Ft. Ship.

Mr. Nixon, for I may refer to him now in connection with these mercantile ships, because I am circulating between mercantile and warships, rather looks forward to ships 1,500 ft. in length and thinks they could be made to pay. I do not profess to be an authority on the subject, but must respectfully beg to doubt that, unless there are radical changes in all existing conditions—I do not believe they can be made to pay, but I go further and say if these vessels of such length were made with proportionate dimensions of breadth, depth and draught of water, such as the naval architects would desire to have, other people than the ship owner and the naval architect will come into the proposition, namely the harbor and dock authorities, and we have got up against that. You have limits to reach in regard to the depth of water. The Ambrose tunnel has 40 ft. A depth of water of 40 ft. is satisfactory under existing conditions; but what would be the proportionate draught of water one would wish as a naval architect to give a ship 1,500 ft. in length, and what is likely to be the view of the harbor authorities in regard to the cost and work necessary to prodive that accommodation?

In dealing with this matter you cannot dissociate the ship owner and naval architect from the harbor and dock authorities. It is a national thing in every case. It is perfectly true, and I have alluded to it in the paper, that up to date various nations have spent huge sums on dock and harbor improvements, and return has been made on them. I have dwelt on the fact that some nations have very wisely and for the purposes of the national well-being, considered as a whole, embarked in a large expenditure which yields no return and perhaps never will, but yet pays the nation as a whole.

Down to 40 Ft. Draught.

In connection with these harbor and dock improvements, Mr. Nixon speaks of 16 ft. of water and 18 ft. of water and 21 ft. of water. We have got down to 40 ft. of water. Any one who has had to do that work knows how vitally the cost increases as you increase in the depth of excavation. It is a problem with which I have some familiarity, and it is perhaps for that reason I do sympathize strongly with the view that we naval architects—and I am a naval architect, as you know—must not think that the whole world is created for our welfare. We are only one item, and we must think of the welfare of the nation as a whole, and what will be for its benefit.

I will now pass to the warship; but please remember the merchant ships. It would grieve me if they were not remembered. I am not here to advertise the Mauretania or criticise the administrative work of great ship owners, as to the type of vessels they adopt or the large expenditures they make. I am endeavoring to illustrate and describe principles which, it seems to me, must have a future influence on the development of the size of ships.

Originator of the Monster Warship.

We come now to the warship. If you ever saw a man in a difficult position in this regard. It is an evidence of how aged I must be getting, when people forget I was the man who was criticized for building monster warships. I was the man who brought in the monster warship. People forget it, but I cannot. I had to defend the royal sovereign class which were the largest warships built up to that time, 22 years ago. I increased the size of the ships, for which I was responsible and believed I was doing the right thing.

I am not an advocate of small dimensions. Admiral Bowles spoke of the small ship in which the magazine will be crowded into the neighborhood of boilers and bunkers. Do you think there is anything of that kind in me? Do you think there is anything of that kind in any ship I was responsible for? Certainly not. The one thing I stood out for, for years, was that I would not have magazines placed in the neighborhood where the explosives would be exposed to the influences of high temperatures.

Our discussion has gone off on to a phase with which I have no concern. I am no advocate of small ships; small, large—it reminds me of the thing that used to be told when I was an apprentice. What was the size of that? Here is a piece of chalk—a small piece of chalk. What does it mean? We cannot deal with these things in any such vague manner. I am not advocating small ships. I am advocating ships so large they will have the power to maintain speed at sea and to be able to fight in all weathers when an action can be fought. That is my idea of the question of the size of warships. I believe that the undue multiplication of heavy-gun positions in individual ships is a mistake. I argued that last year, and my arguments stand. I disagree with the view that a ship of what I call more moderate dimensions than the present ships must have her magazines near her stoke holes. It is not so. In fact, if the fundamental principle which I endeavored to lay down last year is a fact, and if the four commanding positions towards the ends of the ship are occupied with the heavy-gun stations, whether you have two guns each, or one, then you get rid of the difficulty of having the guns or magazines near the stoke holes. Therefore, the argument that the ship cannot maintain her speed at sea and cannot spike her guns falls harmlessly on me, as I do not advocate it. My advocacy is to return to more moderate dimensions and unit cost than we have, because we have them under existing conditions, to put in that number of heavy-gun positions, and to attain the speed and the radius of the action, thus giving conditions to the naval architect, without involving an increase in size, in draught of water, and above all in unit cost, which I look upon as objectionable. That is my proposition. I want these to be reconsidered.

Must Regard Harbor Accommodations.

Further, I say that in regard to both war and merchant ships, you must have regard to the question of harbor and dock accommodations, and the harbor and dock accommodations must be considered so as to be ready in time for the use of the ships, and if I were concerned with harbor and dock accommodations, which I am not financially, although personally I have been consulted to a very great extent in connection with the work mentioned in the paper, I should say you always ought to associate with the building of ships, whether mercantile ships or warships, the definite assurances that when the ship is completed she shall be dockable, and capable of using the terminal port. The question of the equipment of the port for the handling of the cargo is also an important question, but it is not equivalent in importance to that of harbor and dock accommodations.

In connection with our great schemes of construction for the British navy, for which I was responsible, we always had our scheme of dock accommodation framed and worked out at the time that we were getting our ship constructed; we had a com-

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plete program regarding the dock construction so that it would be finished in time for the accommodation of the ship. Never in my time did we have a ship completed that could not be docked. I will not say anything about whether that is true now, but I do say this, that when, in connection with my work for the Admiralty, which involved an expenditure on ships for which I was responsible of 100,000,000 pounds sterling, we also had a dock and harbor scheme, which was carried into effect, which amounted to $110,000,000, or 22,000,000 pounds sterling. The two things went on together.

Heavy Gun Positions.

Now we come to the question discussed last year about the multiplication of the heavy-gun positions in the ship. Admiral Bowles quoted from the speeches made at the congress of the Institution of Naval Architects last spring. As I was then doing the duty of president, and sat in the chair, I was not indulging in the controversy. You probably can hardly believe I could sit still while the question was being discussed, but that was the fact. I never said a word. When Admiral Bacon said that the biggest ship was the least vulnerable, he was speaking more particularly of the big-gun ship. In the same way Admiral Bacon said that the biggest ship that could be built would be put out of action, could be made unserviceable for the succeeding period, by any single successful explosion of a torpedo, marine torpedo or submarine mine. She might not be sunk, but she would be put out of effective use.

In the discussion which took place 22 years ago, to which I have alluded, when I was the champion of the then so-called monster warship, I used a simile which is well known in military work. It is this—that the big place, in the military sense, is always the safer place, if you have an adequate garrison within. The small place is more likely too small than the big place, if you are adequately garrisoned. The same principle holds true in regard to gunfire. A single shell explosion in a large ship is likely to do less damage than a single shell explosion on a small ship. When you come to under-water attack by mines, torpedoes and submarines, then this very champion of the big ship, Admiral Bacon, admitted that the biggest ship would be put out of action for the immediate succeeding period by a single successful under-water attack. That is the crucial point of the discussion in my paper, the development of the under-water attack makes it undesirable to mass so many guns in one ship which may by a single successful under-water attack be put out of action for that battle. Not a word said today touches that feature.

A Return to More Moderate Costs.

We were told by Mr. Nixon that the axiom "too many eggs in one basket" had been done to death and disposed of, but he did not say why. I think it has been disposed of, but not in the sense in which he thinks it has been disposed of. We agree in the conclusion, in the general terms, but we do not agree in the application of the conclusions. But as certain as we are here, in my judgment, we shall see a return to more moderate costs. Mr. Nixon, perhaps, will help us in these wonderful possibilities of the future to which he has alluded in a somewhat distant manner.

I have the advantage of having gone through this career of a designer of warships and come out on the other side. I never intend to go in again. I have had my turn at it. I am now a watcher by the way, interested in all the work being done by the younger men in connection with warship design and marine ship design, and the last word I would like to say, sir, is that this paper was avowedly written to provoke a discussion, and I think it has not failed to do so. (Applause.)

The President: Gentlemen, we have certainly had a most interesting discussion on this paper by Sir William Henry White. It looks to me as if the pupils had taken a twist out of the schoolmaster, but the schoolmaster is still on top.

A vote of thanks was tendered Sir William for his paper.

Dock Facilities in New York City

THE second paper to be read was Wm. J. Barney's paper on "Dock Facilities in New York City; Present Facilities, Proposed Improvements and Enlargements." The title of this paper is sufficiently comprehensive to indicate its scope. The author divided the problem by classing the freight to be handled into four divisions: First, that which enters and leaves New York merely as a port of entry for trans-shipment to foreign countries or other ports of the United States; second, the foreign trade coming into the port of New York for direct consumption in the city of New York; third, passengers landing in Manhattan; fourth, the condition of freight handling caused by the fact that Manhattan is on one island and Brooklyn and Queens on another. This freight is largely handled by the railways. Mr. Barney's paper was illustrated with a very large number of lantern slides and proved a most interesting paper.

After the reading of the paper adjournment was taken for luncheon. Immediately upon reconvening the discussion on Mr. Barney's paper took place.

Capt. J. W. Miller: I think the paper that was read by Mr. Barney is very interesting, not only on its own account, but because of the information which it gave us regarding the port of New York, and also on account of its relation with the paper which preceded it. Sir William White made a point of the fact that no matter what ships we might build there entered into the problem the relationship between the ships on the sea and the people on the land; that is to say, that we do not need only ships to cross the ocean, but we also need the facilities to take care of the ships when they reach such ports.

Now, this paper of Mr. Barney's is the result of his studies, and the result of a systematic study of the present commissioner of docks and ferries in the port of New York, Mr. Tompkins. I think we have to thank Mr. Barney, and through him Mr. Tompkins, for the very great interest they have taken in this subject, and I, as a man who have had something to do with this commerce on the water front for some 20 years, wish to express on my own behalf the thanks of myself and of other people on the water front for the great interest which the department has taken in developing this great national harbor of the United States.

There are some points, however, which it seems to me might be touched on here in this discussion.

The system by which and through which the dock department is talking of making the new piers is to throw the railroads out of the lower part of the city and put them in the upper part of the city. As long as the great dry goods interests and

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the other interests which now congregate in the lower part of the city, below Fourteenth street, remain where they are, the steamships which bring the large amount of local freight from the eastern part of this country to New York must remain where they are. The immense amount of storage for the manufactured product of New England today remains below Fourteenth street. That part of the city should ultimately, of course, be given up to other purposes, and in the far reaching plans of the dock department they are right in sending these ships to the neighborhood of Fourteenth street and that region, but it will take a long time before that is done, and in the meantime it is essential that the transfer between the $150,000,000 of freight from New England per annum shall be in close contact with the shore warehouses, which are not far removed from these piers. The problem is a great one, and will only work out in time.

The second point I want to raise in the discussion is this: That while we are talking about the development of the port of New York and the commerce of New York, there is a development of this principal city of the United States which should be given consideration. Here we are with only one outlet to the sea. It seems to me, instead of putting so much money into the Jamaica bay and that region, that we citizens of New York, and I speak not locally, and the principal manufacturers of this country in the east, should bend our energies to giving two outlets to the ocean.

A Wonderful Channel.

From the navy yard to Hart's island lies the most wonderful channel that any city in the United States has, except the lower bay. It is behind the times, it has not been improved in the way it should have been improved. In case of a sudden war no dreadnought can with safety leave the navy yard and go to the eastward. The rocks in Hell's Gate and the current in that locality and the shallows would make it dangerous, and I believe that application should be made at once to the United States government to dredge out that channel, remove the rocks and excavate in the shallow places, so that our ships could go to sea in an eastward direction. The government should do for this metropolis what it has done for minor points along the Atlantic coast. With a very small amount of money we could have a double track at Hell's Gate, not only for our commercial ships, but for our men-of-war. It can readily be seen that in a time of crisis our Dreadnoughts should be able to go from the navy yard to the eastward as well as to the westward, and if we had 24 ft. of water from Blackwell's island to the North Brother island, we could not only use it in time of war, but we could develop on the northern shore of Long Island and on the southern shore of the Bronx a large amount and number of freight houses at less expense, provided the government gave us that channel, than we could do at other points.

There is still one further point I should like to touch on, and which was referred to by Mr. Barney. We are a commercial people; we want to make money, we want to have all the dock facilities we can have, but we are more than that in New York, we are the chief city and harbor of this western continent.

The American Fleet in the Hudson.

There was exemplified here some two weeks ago the fact that the largest fleet of the second power of the world was anchored in the Hudson river. The people of the city, of the state and of the United States were endeavoring to get access to our great New York. There was no means, proper or dignified, by which they could do so. Here is a stretch of land from Seventy-second street to 129th street, shown on the map exhibited by Mr. Barney, which is the most wonderful and beautiful spot in the world. There is alongside of it what is known as the Riverside park, which is neither on the side of the river nor does it approach the channel. Beyond that, at the foot of the hills, are 300 ft. of shallow water, as was also shown.

Now, while we want to develop everything we can for commerce, we ought also to provide on that water front a dignified reception place of the foreign navies of the world and all the dignitaries who may visit us by water. It should be the water-gate to this country for all the officials that may approach us from the ocean.

National Water Gate.

This matter has been before various organizations for the last ten years, the result being that the Fulton Monument Association, the Columbia college, the New York Central railroad, the Naval Alumni Association of the United States and other bodies are ready and prepared to do their share to give a proper and dignified water-gate and reception place to this city. Between Seventy-second street and 129th street all the official marine affairs of the city, the state and of the country could be consolidated. The nautical schoolship of the city of New York, the naval militia of the city and state of New York should be located there. No ground would be taken from the park department, but grounds created and land made of the shallow places in that region.

W. D. Forbes: This paper suggests to me a story that is told of Alexander von Humbold. He was invited to a dinner one evening, and was sitting on the right of the hostess, and in the good, German fashion she was to do the carving. She turned to him and said, "Alexander, I understand you are the best educated man in the world; please tell me all you know while I am carving this fowl." It seems to me we have a problem before us something like that. It is very satisfactory to me to know it is being carried on as it is under such able management, but if you will notice, gentlemen, they are talking about the harbor of New York, but left my state of New Jersey completely out of it. Now, I am a little proud of the state of New Jersey, and I think if the department of docks and ferries would look over in that direction they might see something which it would be to their interest to take advantage of. It may be that it is contemplated, and I would like to ask whether it is contemplated to use the Jersey shore, because back of the Jersey shore, gentlemen, lies the whole United States. This section is not by any means the greatest part of the United States. The eastern part of the country has a few places, and Boston will take care of them; but on the Jersey side is the whole distribution of the United States, and it seems to me that certainly should be looked into with care.

Disputes the Logical Plan.

F. L. Du Bosque: I did not care to say anything on this paper, but I would like to make a certain criticism of one statement contained in the paper, as follows: "The logical plan for handling these four classes of freight would be to reserve the water front and the immediately adjacent upland for the maritime commerce." I think the logical plan is to do just the contrary. The whole effort of the commission seems to be to take care of ships bringing passengers and freight to New York, and to edge out all classes of freight.

It is true that the railroads do occupy a majority of the river front, but the reason is not very far to seek. The policy of the city of New York has been to give the steamship

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companies a long time lease with all kinds of facilities which they want at a very low cost, but to give a railroad company a lease not extending over one year, at a most exorbitant charge, compelling them to do all the improvements at their own cost. That is the reason why so much of the water front of New York is occupied by the railroads.

The result of the scheme suggested here—I cannot express it as my own personal opinion, but as the opinion of a great many people who have examined it—is that it will increase the cost of the delivery of freight by railroad companies to the city of New York at least 25 cents a ton. Some people think also that the scheme is somewhat impracticable.

Catering to the Most Profitable Freight.

Now, if the railroad companies are bringing to and taking from New York city probably ten times as much freight as the steamship companies take away, it seems to me as though the logical conclusion was not to cater to the steamship freight, but to cater to the most profitable freight. I feel there is ample room to accommodate the passenger travel and the express freight in New York city on the Hudson river front, and also take care of all the railroad freight that comes to this point, without any such elaborate arrangement as here suggested. The fact is that the most profitable and most satisfactory arrangement for taking care of the steamship freight, as pointed out by Mr. Barney, is now being pursued at the Bush Terminal, in Brooklyn, and if the commission would lay out a scheme that would segregate the freight arriving in the city of New York, at points where the land is not so valuable, and give the railroads a very small portion of the river front, with long-time leases, allowing them to go to the expense of putting in modern mechanical facilities for handling through freight, I think the solution of the problem would be more profitably reached.

An Advisory Board.

Sir William Henry White: Of course, Mr. President and gentlemen, you will understand in regard to the port problems of New York, I would not be guilty of the impertinence of saying a word. Those who have to do with the work of the traffic of this harbor are the best judges of that, and in speaking of those who have to do the work, I am not speaking of the port authorities, but I am thinking of those who are interested in the problems of the port, as ship owners, merchants, and in any other way.

Now, perhaps our experience in England may be of some service to New York in this matter, and our experience is this—that the most satisfactory way of developing the resources of any port is to constitute a local authority of an advisory nature which shall consider and discuss questions of policy, and to make that representative of all the interests affected. The Mersey docks and harbor board is such a body, and with reference to one speaker who pleaded the cause of New Jersey, I might say at the outset there was a separate authority on the Cheshire side at Birkenhead from that which existed at Liverpool, and the tendency, of course, was to develop everything on the Liverpool side, and, although docks had been independently constructed at Birkenhead, they were not fully utilized until a single authority was put over both. That in England is done by parliamentary power. There is an act of parliament passed and authority set up. Now, in Liverpool and on the Tyne perhaps where some of the greatest works in naval navigation and commerce have been carried on, everywhere the system prevails of having local boards, not of an executive nature, but of an advisory nature, with a settled policy, and which is supposed to give consideration to the claims of all who are interested. Then, of course, with these boards are associated professional men, civil engineers and others, traffic managers and men skilled in details of business, and that scheme works. I cannot imagine that even the best informed executive, apart from the special knowledge of those whose interests are affected, can suffice, and then, within the last two years, on the River Thames, to which I alluded in my paper, but did not read that passage, we have had a number of private companies owning docks and competing with one another, and the only way out of that was by act of parliament to constitute a new port of London authority, which was given by parliament power to raise the funds and frame the schemes of improvement and treat London as a whole, and that is what is wanted in any port if the best use is to be made of it.

Reply of Mr. Barney.

W. J. Barney: I will take only a moment. I can see the application of that turkey story, because in attempting to present the problems connected with New York harbor in a single paper is a pretty large subject.

Speaking of the river-gate at 116th street, for example, that is contemplated in the plans of the dock department in connection with the Riverside drive development, and the proposed ultimate commercial development, shown on the slide, that was simply a suggestion of what could be done at some future time when commerce invaded that section. As a case in point, the old Washington Square residents rebelled at the idea of plans being laid out for the development of Washington Square as a business center, but that is coming to pass. The present idea of the dock department is that Riverside drive shall be what it is, a park for the people, and the development of it is contemplated in such a way that the future commerce can come in there with the least injury to the artistic surroundings.

Then another thing that we have planned is a yacht basin at about 158th street. At present, along Riverside drive, there are innumerable yachts scattered all along the river front. These are details you cannot cover in the paper.

The Matter of Leases.

One of the gentlemen spoke about leases. I think perhaps I am in a position to state that I think he is misinformed both as to the past and present policy of the city in the matter of leases. The best policy of the city has been to make leases from 10 to 20 years, not only to steamship companies, but to the railroad companies, and practically 40 per cent of the piers I spoke of are now tied up in leases which run from 10 to 20 years, and that will make it difficult to go ahead with the improvements which are contemplated.

That is the past policy of the city, both as to steamship lines and railroad companies. The present policy with regard to leases is, as the present leases expire, to make the leases from year to year, not only for the railroads, but also for the steamship companies. The Maine Steamship Co., the Bermuda Steamship Co., and other steamship companies now occupy their piers under one-year leases. The Pennsylvania Railroad Co. has only a one-year lease for its piers. The idea is to loosen up the situation as fast as possible to get it in control of the city.

I cannot go into the pros and cons of the system by which the use of the waterfront is given to the steam-

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ships and railroad companies, and the method by which the railroads are given the privilege to put in their freight-handling devices, etc., and the steamship lines as well.

The point which you must bear in mind in connection with the traffic in New York is this—that if the railroads today installed on their piers freight-handling devices to increase the capacity of the piers 50 per cent, and if they still occupied the water front, and the railroad traffic is increasing at 10 per cent per year, in five years with the ratio of increase of business, the conditions would be the same, relatively, as they are today.

Some critics of Commissioner Tompkins say that he is trying to disturb the railroad and city freight, and is in a way favoring the maritime commerce. Commissioner Tompkins is the best friend the railroads have today in that respect. The New York Central Railroad Co. knows that its tracks must come up sooner or later from Eleventh avenue. There is only one practical way to dispose of them, and that is to put them on an elevated structure, and give them connections downtown. The New York Central today stands ready to build that railroad with its own money and take it over as a practical monopoly for the transportation of freight on West street, free from competition, but Commissioner Tompkins is standing out to give the New Jersey railroad an opportunity later, when conditions make it imperative, to come in on this municipal belt railroad. He is a good friend of the railroads.

Port Administration.

To pass to one other point. I am not only immensely pleased that Sir William Henry White honored the paper with a notice, but I am glad he brought home to our attention what is the basis of the whole business in New York, and that is port administration. My paper does not pertain to the accommodations for large ships, but that is the crux of the whole problem in New York and always will be—to have a proper administration of the port. These matters should be administered by a continuing board. The commissioner of the department of docks and ferries usually holds office for a comparatively brief period, and it takes him some time to get even a glimmer of the size of the proposition which confronts us here in the city. At the end of four years the chances are he will leave office, and some one else take the office to learn the problem over again.

You must have a port authority, and what the present commission is trying to do is to do exactly what Sir William suggested with relation to the Mersey harbor and dock board. Certain members of that board represent the chamber of commerce, and certain members come in to represent other interests concerned with the administration of the harbors and docks of the city. The commissioner here is doing that, in an unofficial way, by going to our chamber of commerce, and the various boards of trade, and asking them to appoint committees to confer with him, and he is trying, unofficially, to make the port policy of New York City the policy which will best represent its commercial interests.

Loading Coal at Curtis Bay

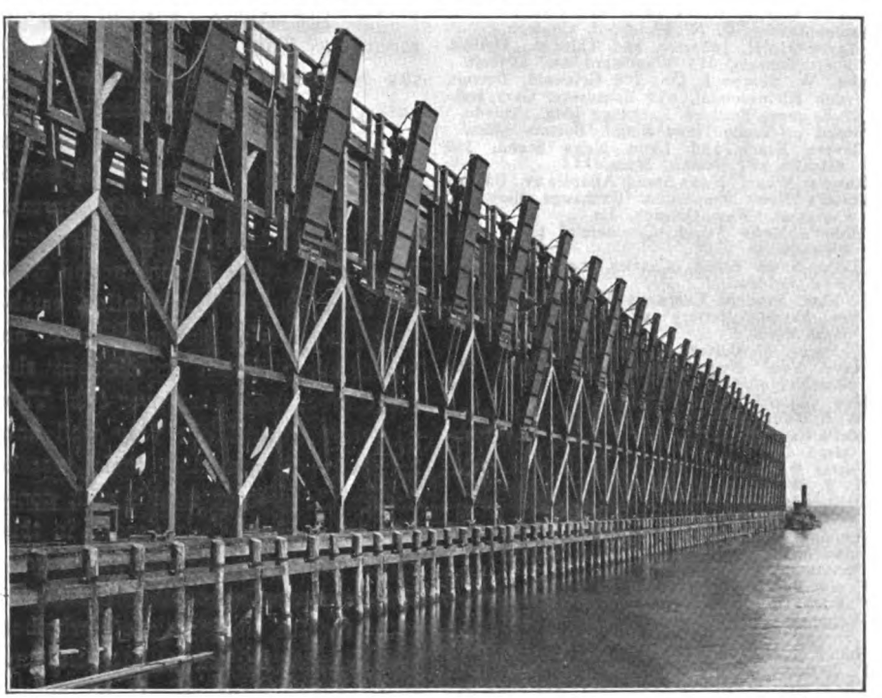
A creditable record in loading coal aboard ship was made in Baltimore, Nov. 23, at the Curtis Bay coal pier of the Baltimore & Ohio railroad, when the collier Newton, owned by the Federal Coal & Coke Co., was loaded with 7,029 tons of cargo coal and 545 tons of bunker coal. The time required to load the vessel was four hours and 35 minutes, work having been begun at 8:15 a. m., and the last ton was placed in the bunkers at 12:50 noon. All the coal was loaded directly from cars and 30 minutes additional time was consumed in trimming.

The Newton reached Curtis Bay early in the morning and preparations were immediately begun for loading. Workmen employed on day shifts were just arriving at the terminal when the vessel tied up. Within a short time long trains of coal cars were started up the pier and 50 men began dumping their contents into the holds of the ship. In all 166 cars were unloaded.

The record perfomance of loading the Newton recalls the recent loading of the government collier Neptune, last July, when 13,000 tons of cargo coal and 2,200 tons of bunker coal were placed in her holds in a working day; but the loading of the Newton was handled even more expeditiously than when the government collier took on her cargo.

The receiving yard at Curtis Bay has a capacity of 2,500 cars, and this is being enlarged to accommodate 3,500 cars. The length of the pier is 800 ft. There are 25 pockets on each side of the pier for dumping coal into the holds of the vessels, the dumping capacity averaging 1,000 tons an hour on each side.

This record is, of course, quite notable, and shows that the coast is improving rapidly in dispatch in handling bulk freight. No attempt after a record has been made on the lakes this year, though next year undoubtedly all records will be smashed. The new McMyler car dump, at Lorain, on June 3 last loaded 9,792 tons of cargo coal and 265 tons of fuel, a total of 10,057 tons, on board the steamer C. A. Weston, in 6 hours 35 minutes working time, an hourly average of 1,530 tons.



COAL PIER OF THE BALTIMORE & OHIO RAILROAD AT CURTIS BAY

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Announcement

Owing to increased costs and the ascending scale of everything pertaining to the publication of second-class periodicals the subscription price of THE MARINE REVIEW will be advanced to $2 per annum, effective Jan. 1, 1912. This step, long deferred and ever contemplated with reluctance, has now been rendered imperative through the mere pressure of increased expenses of operation. It is this situation that has compelled many publishers to advance the subscription price of their magazines during the past three years.

Obviously all new subscriptions and renewals received before Jan. 1, will be entered at the old rate.

Saving Money Aboard Ship

Leading interests in the Lake Carriers' Association have for several season's past endeavored to formulate some plan whereby the men aboard ship, especially the unlicensed men, might be able to save a part of their money. Until within a year or two the practice has been followed of paying the men at the end of each trip, although during the past two years some of the companies, notably the Pittsburgh Steamship Co., introduced the check system, paying monthly. This has worked out to the advantage of the men in many cases, though it left unsolved the problem of having a part of the money actually deposited in some bank to the credit of the seaman. Last spring, however, the Cleveland Trust Co., acting in conjunction with the Lake Carriers' Association, established a marine savings bank on board every vessel enrolled in the association, numbering over 500. This plan has worked out very well and hundreds of men left their vessels during the present month with comfortable sums to their deposit in this bank. The plan evolved was a very simple one. The captain would usually inquire in paying off whether the seaman desired to deposit any part of his earnings. If he did, a New York draft would be made out for the sum mentioned and the balance given to him in currency or in the form of a check. The draft would then be mailed to the bank and deposited to the seaman's credit. As a rule the deposit book was left with the bank, the bank supplying each ship with the necessary forms for depositing and withdrawing money without the necessity of presenting the deposit book each time.

Some time ago the bank offered prizes for the three best letters setting forth reasons why the sailors should bank their money. Seventy-eight letters were submitted in the competition and they certainly approved the wisdom of the association in endeavoring to help men safeguard their funds. The letters cannot be read, however, without the thought occurring to one that probably the duty of the association is to go a little further than merely helping the men safeguard their money. The complaint of petty pillage occurs and recurs throughout the series of letters to such an extent that it would seem to be common practice for some scoundrel aboard ship to rifle trunks or suit-cases in search of money. Quite a number of instances of theft are reported and some of them are quite pitiful, bringing misery upon the victim and those dependent upon him. It would be a very good idea to evolve some plan of punishment for these offenders. If an example was made of a few of them there would be less of this sort of pilfering.

The other temptations spoken of in the letters are merely incidental to the sailor in port, though these pitfalls are not alone for sailors, but sailors probably fall into them oftener than landsmen. Many of the letters indicated that a great deal of money was lost through carelessness or forgetfulness, as for instance, pulling it out of one's pocket with one's handkerchief.

There is no doubt whatever that this banking arrangement is one of the very best things that the Lake Carriers' Association has put into practice. There is really no reason

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why a lake sailor who is single may not practically save all of his wages. Everything that he has need of is aboard the vessel; in the way of creature comforts he is abundantly cared for. The food scale is not only ample, but in many cases actually lavish and their quarters have all the conveniences that it is possible to obtain ashore.

Stopping Shanghaiing

It has been known for many years that shanghaiing has been practiced in the oyster fleet operating on Chesapeake Bay and its tributaries. Considering the fact that the practice was generally known and being of frequent comment in Washington, it is curious that the government has been so tardy in suppressing it. The government now, however, has gone at it in a thoroughly business-like way and the practice will in all probability be wiped out. The attention of the department of commerce and labor was brought acutely to the subject by the case of John McNamara, a reputable family man of Williamsport, Pa., who went to Baltimore on business and was shanghaiied and turned over to Capt. Aldie Dorsey, of the oyster sloop Irene and Ruth, and who was drowned in attempting to escape from the vessel. It appears that McNamara frantically begged to be put ashore and allowed to rejoin his family, but permission was refused. As stated, in endeavoring to escape, he was drowned. Shortly thereafter Capt. Dorsey was murdered by three members of his crew, two of whom received such severe wounds that they died before their trial was called.

The government started an investigation which resulted in the conviction and imprisonment of the men who had drugged McNamara. The investigation revealed many appalling conditions and the government has now purchased a power yacht having a speed of 12 miles, well manned and well armed and capable of going anywhere that an oyster sloop can go. It is the intention to keep her actively cruising in the oyster districts and undoubtedly she can do much towards suppressing the practice. Congress will also be asked for an appropriation to extend the surveillance to all the districts. The oyster fleet is in fact quite an extensive one, there being 928 vessels enrolled in Baltimore alone, while Crisfield has 673, Annapolis 196 and the various Virginia districts 1,429.

The brutalities attending this trade are almost unbelievable, but unfortunately they are all susceptible of proof. Seamen have been drugged and carried to oyster boats. In many instances they have been put ashore far from inhabited places without any wages having been paid them. The instances of disappearance and drowning have not been uncommon, and it is charged that many of the men have been kept at work by officers with clubs, while others have been beaten and forced to work until they fell exhausted.

Obviously, there is no reason why the oyster trade may not be conducted as respectably and decently as any other trade.

Lake Season Ended

The season of navigation on the great lakes closed on Nov. 30, though a number of vessels are operating under excess insurance in the coal and grain trades. No ore was shipped after Nov. 30, and all the ore carriers safely reached port without a single casualty. The coal shippers appear to have been caught somewhat, as a number of them were quite eager to send coal forward at decided premiums. Several of the vessels got $1 per ton and some of them received handsome contracts for next season's delivery as well. Good premiums were also paid in the grain trade, ranging from 4 cents in some instances to 6 cents, so that these cargoes were very profitable to the vessel owner. In general, however, very little profit has been made by vessel owners during the season of 1911. The ore rate was 10 cents lower than during 1910, and about 10,000,000 tons less of this commodity were shipped. Obviously it was impossible for all the vessels to be steadily employed and a number of owners were unable to get all of their ships in commission until September. Earnings, therefore, have been on a very modest scale and dividends will be very light, if any at all are declared.

The fall months were reasonably free from accidents. Usually the underwriter has had reason to dread the heavy weather of the closing months, but this year the casualties were few and of minor importance. It would not be surprising if the underwriters have had a good season on the lakes. It is to be hoped, of course, that they have, as the Great Lakes Protective Association has done everything possible to minimize accidents in the hope of securing a reduction in the insurance premium, which has become almost prohibitive.

Bid in Second Mortgage Bonds

The Guardian Savings & Trust Co. as trustee for four Cleveland banks and the American Ship Building Co. bid in second mortgage bonds of the Gilchrist Transportation Co. in the sum of $3,000,000 for $975,000 on behalf of the creditors on Nov. 11. The banks and the American Ship Building Co. loaned the Gilchrist Transportation Co., $1,500,000 three years ago to facilitate the reorganization of the company, taking a second mortgage for $3,000,000 on the fleet as security for the loan. The company could not meet its obligations and the stockholders were apparently unwilling to put up any money to protect the bonds and so the creditors had no option other than to buy them in. Ahead of the second mortgage bonds as a lien on the fleet of the Gilchrist Transportation Co. are about $1,400,000 first mortgage bonds and $870,000 receiver certificates. The fleet was appraised at $5,500,000 last March.

Capt. Nelson as Supervising inspector

Capt. N. B. Nelson, local inspector of hulls, in the Cleveland district, has been recommended for appointment as supervising inspector to succeed the late Capt. James Stone by Senator Burton. The recommendation of the senator is regarded as conclusive, and Capt. Nelson's appointment is expected to follow as a matter of form. In vessel circles the appointment is regarded as quite fitting.

The annual meeting of the captains and engineers with the officials of the Pittsburgh Steamship Co. will be held at the Hollenden hotel, Cleveland, during the first week in January. President J. A. Farrell, of the United States Steel Corporation, will attend the annual dinner on Jan. 3.

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Ore Shipments

Ore shipments during 1911 were 32,130,411 tons as against 42,620,201 tons for 1910, a decrease of 10,489,790 tons or 24.61 per cent. The shipments during November were 2,523,253 tons which is a decrease of 118,633 tons from the November movement during 1910. Conforming to the policy adopted by the ore shippers two years ago, no ore was shipped after Nov. 30. A large part of this ore was unloaded directly into cars, so that the stocks of ore on dock as of Dec. 1 may not be as large as usual. These figures are now being compiled by *The Iron Trade Review*. With the exception of 1908, the movement of ore this year is the smallest since 1904. The shipments for the past eight years have been as follows:

1904	21,849,401
1905	33,476,904
1906	37,513,595
1907	41,288,755
1908	25,427,094
1909	41,683,873
1910	42,620,201
1911	32,130,411

Shipments by ports during the past two years are tabulated as follows:

Port.	Nov., 1910.	Nov., 1911.
Escanaba	452,351	513,790
Marquette	250,426	244,135
Ashland	276,152	168,909
Superior	635,002	605,531
Duluth	519,893	476,563
Two Harbors	508,062	514,325
	2,641,886	2,523,253
1911 decrease		118,633

Port.	Season, 1910.	Season, 1911.
Escanaba	4,959,869	4,278,445
Marquette	3,248,929	2,203,380
Ashland	4,093,822	2,429,290
Superior	8,437,261	9,920,490
Duluth	13,609,155	6,934,259
Two Harbors	8,271,165	6,367,537
	42,620,201	32,130,411

Lake Erie Ore Receipts

Out of a total ore movement of 2,523,253 tons during November, 2,385,668 tons went to Lake Erie ports, distributed as follows:

Port.	Tons.
Buffalo	225,988
Erie	114,699
Conneaut	444,297
Ashtabula	651,812
Fairport	16,109
Cleveland	486,064
Lorain	285,172
Huron	10,492
Sandusky	.....
Toledo	104,377
Detroit	46,658
Total	2,385,668

Coal Handling Plant

A coal handling plant, to be equipped with a new class of coal handling machinery, has been ordered from the Wellman-Seaver-Morgan Co., Cleveland, by the Canadian Pacific railway for installation at the Fort William, Ont., dock of that road. It is to consist of two Hulett unloaders with automatic buckets of eight tons capacity each, and having an hourly capacity of approximately 800 tons. The machines will be electrically driven with direct current of 220 volts, the power being transformed from high voltage alternating current to direct current at a substation of the dock.

A trestle and bin system, to be constructed at the immediate front of the dock, will be provided with 30 bins arranged to deliver coal to double-ended box car loaders traveling underneath them. The arrangement will be such that strings of cars may be spotted at the bins on each side and loaded, one after another, before being removed, thus affording greater shipping facilities than have ever before been provided on the great lakes coal docks. Another new feature will be the introduction of 35-ton transfer cars which will carry coal from the unloaders to these bins. These cars will be so constructed as automatically to weigh a pre-determined amount of coal; hence the cars on the siding, containing a known quantity of coal, may be switched to the main track for shipment without further weighing or trimming.

Back of the unloaders and bins will be a conveyor bridge operating a nine-ton coal bucket and commanding a coal storage space of 285 square feet. This bridge will stock coal which is not directly shipped and will rehandle into conveyor cars for loading out. The coal bucket on this bridge will have the unusual capacity of 350 cu. ft. Protection against the breakage of coal is to be provided throughout the entire plant. The length of the dock is approximately 3,000 ft.

This will be the first application of the Hulett unloader, so widely known in connection with the handling of iron ore, to the coal trade. The Wellman-Seaver-Morgan Co. will be assisted in the construction of the plant by the Van Dorn Iron Works Co., Cleveland.

Savings Bank Aboard Ship

THE Lake Carriers' Association for a long time has endeavored to formulate some plan whereby the men aboard ship might have banking facilities and safeguard their funds. During the past season the Cleveland Trust Co., acting in conjunction with the Lake Carriers' Association, had a marine savings department aboard every ship enrolled in the Lake Carriers' Association and it has proved quite successful. The plan is very simple. When a member of the crew goes to the captain for his pay the captain asks him if he desires to deposit a part of it in the bank. If he does he gives him a draft for the amount and pays him the balance either by check or in cash, according to the individual system prevailing on the vessel. The draft is forwarded to the Cleveland Trust Co. and credited to the sailor's account.

The Cleveland Trust Co. offered three prizes for the best letters from the unlicensed men aboard ship, the first prize amounting to $25, the second prize to $10 and the third to $5. The competition was entered into quite generally, 78 letters being received by the bank, though many more were undoubtedly written, but not mailed.

The letters were submitted by number to a committee of newspaper men and the first prize was awarded to No. 23, the second to No. 19 and the third to No. 32. It developed that Charles S. Ashcraft, 33, 214 Portage avenue, Sault Ste. Marie, who has been sailing as steward for two seasons, won the first prize. Paul L. Berensfeld, 23, 7010 Wakefield avenue, Cleveland, wheelsman, who has been sailing two seasons, won the second prize and John Leski, 26, East Twelfth street, Cleveland, fireman, who has been sailing two seasons, won the third prize. Leski was unable to write English and so dictated his letter to the second engineer. The letters follow:

First Prize.

"In your 'Prize Competition' offer for sailors, I see 'facts' are called for. 'Facts are stubborn things' and in my case will to say the least not be to my credit.

"During the season of 1910 (my first on Great Lakes), I was a steward on a P. S. S. Co. barge. Before I started work in the spring I knew (so I thought) just how much money I would save by the close of navigation as I 'meant to' put some money in the bank for winter, but as I was always in some strange town when I got my pay check, and it was generally after banking hours when we got ashore (if the bank was open they did not know me and no one else knew me well enough to identify me) so there is just one place a sailor can always get his check cashed, just one business man who has the cash and knows you well enough to cash your check (and probably he has never seen you before and never will again) that is the saloon keeper. He always

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has the cash and asks no questions, as he keeps posted on what boats are due, in other words he is your friend (?) and on the job day or night. By the time one leaves his place he feels so friendly toward him and his associates in business (and being a stranger in the city and not knowing what to do or where to go to spend an hour before going back on the boat, which you probably have not stepped off of before in two weeks) that I usually stop in the next friend's (?) place. Here I meet Harry and Bill and things begin to brighten up a bit. By the time we leave them we are positive that the only friends we have in that city are bartenders, so we start out to call on all 'our friends'; have to give it up before 'the rounds' are made. In the morning would find nothing for the money I had spent, but a headache, and the only reason I had for wanting to get my check cashed was to get perhaps two or three dollars for necessary expenses and 'I meant to' put the rest of my money in some bank as soon as I had the chance. Had I been able to deposit a part of my pay each pay-day under the plan now used by the Cleveland Trust Co., I am sure I would have had more than I did have when fall came to winter on. This season I had a mortgage to pay off on a home due Dec. 1, 1911, of $400. I received a position as steward and took my wife as cook on the steamer Bunsen. Again we had it all planned out how easy it would be to save $400 as our combined salary would be $126 a month. That little to save $400, as our combined salary we (at least eight) did not worry and we kept our money on the boat (until we seen something to spend it for). We worked from April 19, 1911, until July 31, 1911, and had not put away a dollar of the $400. During July in cleaning up the captain's room I found one of your circulars so just for the novelty of it I told the captain I wanted to deposit $50 of my July pay with the Cleveland Trust Co. This being the first money I had put in any bank for two years I began to think and figure a little. I had a feeling some might call proud or important, I can't describe it but from that time on I felt more a man and had a desire to save so when we got our checks cashed we sent $50 to the bank who has the $400 to collect for deposit in my wife's name. I was always anxious for pay-day to come, but from then on I was more anxious than before only it was a different kind of anxious. I wanted pay-day to come so I could make another deposit in the bank. There seems to be a fascination about it, watching a savings account grow. When we were paid for August and September, I deposited $50 each month with the Cleveland Trust Co. and my wife $50 each month in our home bank so now when Oct. 31st comes we will have the $400 and can pay our home clear of debt. I give the Cleveland Trust Co. credit for it though, as I am most sure had they not devised the plan now in use I would never have got started. I would always 'meant to' start, but would never have had enough saved to pay for having a renewal of the mortgage made out.

"I say it's all in 'getting the habit' of putting your money away, and next year a part of my pay will be deposited every month in some bank and there is no bank I know of where it's so simple, convenient, inexpensive and safe for a sailor to use as the Marine Savings Department of the Cleveland Trust Co. Any sailor who 'gets the habit' of depositing his money in the bank during the short sailing season can't help being a better man for himself and the company he is working for, as it gives him more confidence in himself and his work (which with fair ability leads to advancement), than the man who spends his pay in one night ashore, and starts the new month discouraged with himself, his company, his occupation and the world in general."

Second Prize.

"Your prize competition for sailors is just the thing I was looking for. Not for the sake of winning a prize, but for the chance of telling all of the sailors just how I happened to start to save money, and why I am saving now. There are many reasons why I am saving my money, but here are two very good ones.

"No. 1.—I am saving now just because I got started to save. It's a habit with me now, and I believe I would have a job on my hands if ever I tried to stop.

"No. 2.—I realize just how good it would seem to be able to walk into the bank and draw a month's pay, in case you had been sick that month, or various reasons why you could not attend to work. I know just how it feels if you can't. Following is the true story of how I happened to start to save my money. I shipped on the old Samuel Mather at the opening of navigation last spring. Shipping was slow and she was the only thing I could get at the time. I couldn't wait because the pit of my stomach kept telling me to get aboard of something. You all know the discomforts of an old fashioned whaleback, so I intended to get off at the first pay-day. I believe it was two days before pay-day that the captain handed me a little folder explaining your method of banking by mail. Your plan appealed to me and I intended to give it a trial sometime in the future. When the captain paid me off, he asked me how much I was going to save this month. $45 'I lied' thinking it is none of your affairs. Never thought of your bank until the sight draft was made out, and then of course it was too late to recall what I had said, and my money was safe and secure in the bank. It seems strange today, but I feel proud that I had put $45 away in one month, and the habit got me right then and there. I also began to feel a little better toward the old boat and instead of wanting to get off I could not wait until next pay-day, so I could place some more in the bank. Consequently I am still on the same boat, and when she lays up I am going to have $300, just because I got started, and that isn't all, I am going to work this winter, just the same and enjoy myself 'moderately' because I've got the saving habit, and when I start sailing next spring instead of being dead broke, I am going to try my level best to have $500 in your bank. Many thanks to your most convenient plan of banking by mail."

Third Prize.

"Our chief engineer, Mr. Lubahn, has just been reading us your circular and while I don't expect to win a prize, I want to write and tell you of the advantage this plan has been to me. The second engineer is writing this as I can't write and can only speak a little English. The season before last my partner and I came to the lakes and shipped as deckhands on one of the large steel steamers.

"We were both married and had our wives and families in Austria, and we wanted to earn enough money to bring them over here. Neither of us knew about taking our money to a bank and we didn't know who we could trust with it on the boat so we kept it in our old tin trunk we had brought from the old country together. We were in Ashtabula loading coal on her last trip up the lakes when my partner came running up on deck to tell me some one had broken into our trunk and taken our money. My first thought was of the wife and kids in the old country whom I expected to see in a few weeks and my

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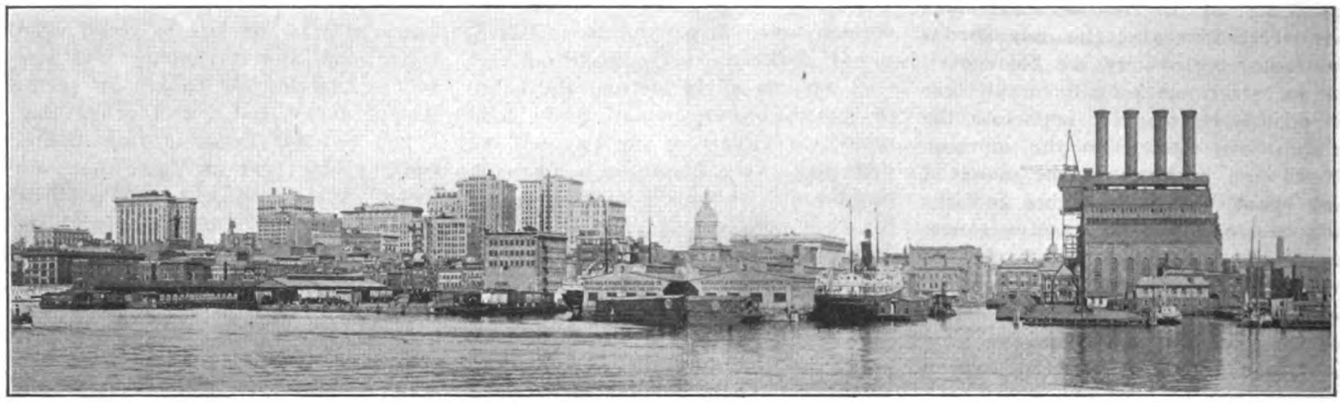
next was to try and get the fellow who had stolen it. By the time we had gotten over our shock and explained to the captain as best we could what had happened, the boat was ready to go. Nobody had time to go up town with us so we got off the boat and had some of our countrymen direct us to the police station. The first thing they asked us if we could give a description of the men who had taken it. We couldn't do this and being unable to talk much English we had to give it up as a bad job and beat our way to Pittsburgh, where we had friends. We spent the winter there and a year ago last spring came back to the lakes and shipped as fireman on the steamer James B. Eads.

"This time we had learned more and were depositing our money in the West Side bank in Cleveland, but our troubles were not yet ended. One trip while laying at the breakwater some one broke into the room and stole $60, and my partner's bank book. This almost discouraged us. My partner ran up to the bank to stop payment on the book, but he couldn't make himself understood and had to get the captain to come up and identify him. I am back on the Eads this summer, and when the captain explained how I could deposit my money and leave the book in the bank it just seemed to fit my case and I think this plan of yours appeals especially to men in my condition. I am going to send for my family in a short time, so they will be in Cleveland by the close of navigation."



BIRDSEYE VIEW OF THE EAST SIDE OF BALTIMORE HARBOR

THE PORT OF BALTIMORE

BY O. F. LACKEY, HARBOR ENGINEER

BALTIMORE is located 150 miles northwesterly from the mouth of the Chesapeake bay, and is connected with the Atlantic ocean by a channel 35 ft. deep and 600 ft. wide. It is known as a land-locked port and one of the safest and best harbors in the world. All that it needed to make it second in commercial importance on the Atlantic coast is a liberal policy and a continuation of the harbor improvements started in 1904. By reason of its geographical location, from its inception, the city became a railroad center. Owing to its wonderful natural harbor, it has always been one of the most important seaports of the country. Had it not been for its natural maritime advantages Baltimore never could have thrived, and what she is today she owes to her wonderful unimproved natural harbor.

Baltimore early became a distributing point for merchandise that came over all seas, from all lands. The ships bringing merchandise were sent back with products of every section of this country. The old Baltimore clipper was famous and sailed every sea and was known in every port long before steam became the propelling force of commerce. Modern methods, inventions and artificial conditions have done a great deal to help Baltimore, but the natural conditions of her wonderful part gave her the advantages over any other city on the Eastern coast, and had she not been handicapped by too much conservatism, she would probably today be the largest seaport town in the country.

Baltimore has been allowed to drift along from the day she was incorporated until 1904, without the city or state showing any appreciation of her unlimited, safe and natural port. After the fire of 1904, the people of Baltimore awoke to the realization, that with the expenditure of a little money the port of the city could be developed to the highest point of efficiency, where she could compete with the other cities for the commercial supremacy of the Atlantic coast.

The waterfront of the harbor of Baltimore is about 18 miles in length and prior to the great fire of 1904 the city owned little wharf property of importance. The fire which destroyed 46 blocks in the heart of the city covering 140 acres made it possible to acquire all of the burnt district front on the harbor and under the $6,000,000 loan the city purchased 4,200 ft. of waterfront property, removed all buildings, streets, etc., and constructed its first eight public wharves and docks south from Pratt street which has been made 120 ft. wide with many streets running into same, also widened and improved.

The public wharves and docks are situated in the upper harbor and are intended for the coastwise and bay trade; the trans-Atlantic steamers at present finding ample accommodations at the railroad wharves with docks 30 ft. deep in the lower harbor. Most of the city piers are leased at 36 cents per square foot on 50 year terms with all superstructure improvements to become the property of the city at the expiration of the lease. Pier 4 is not leased, but is set aside for the market boats. Pier 4 is at the foot of Market Place which has been widened to 150 ft. Along market place the city has erected three handsome commodious buildings, a retail market, a fish market and a wholesale market, with a comfort station nearby and all within a stone's throw of Pier 4.

If it be well to have two blades of

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PRATT STREET SIDE OF THE MUNICIPALLY OWNED PIERS AT BALTIMORE

grass grow where one grew before then to show the importance of each additional vessel to the good of the community, the following instance is cited:

Owing to the excellent facilities afforded the Merchants & Miners Transportation Co. on Pier 3, it has been able to handle much more freight at a less cost than ever before, which made possible its new line to Jacksonville, and while the city gets no increase in rent for the use of the pier, due to the new line of steamers, it gains materially in other ways. It is shown in a carefully prepared table issued by the Merchants & Manufacturers Association, that a vessel bringing in a cargo and taking away another leaves at the port of call 94.7 cents per ton. The Merchants & Miners Transportation Co. has three sailings a week with a net tonnage of 6,796, which at 94.7 cents a ton is, say $386,000 annually, which this one company alone, just from its expense account, adds to the prosperity of the city.

In the coastwise and bay trade some 75 vessels are engaged with from three in each week to daily sailings, and in the foreign trade the following lines of steamers are engaged:

Johnson Line, Baltimore to Liverpool.

North German Lloyd, Baltimore to Bremen.

Puritan Line, Baltimore to Antwerp.

Blue Cross Line, Baltimore to Havre.

Neptune Line, Baltimore to Rotterdam.

Lord Line, Baltimore to Belfast and Cardiff.

Empire Line, Baltimore to Leith.

Atlantic Transport Line, Baltimore to London.

Hamburg-American Line, Baltimore to Hamburg.

Donaldson Line Baltimore to Glasgow.

United Fruit Co. Line, Baltimore to Jamaica.

Red Star Line, Baltimore to Antwerp.

Scandinavian-American Line, Baltimore to Copenhagen and Christiana.

United Fruit Co., Baltimore to San Domingo.

Atlantic Fruit Co., Baltimore to Jamaica.

Atlantic Fruit Co., Baltimore to Sama, Cuba.

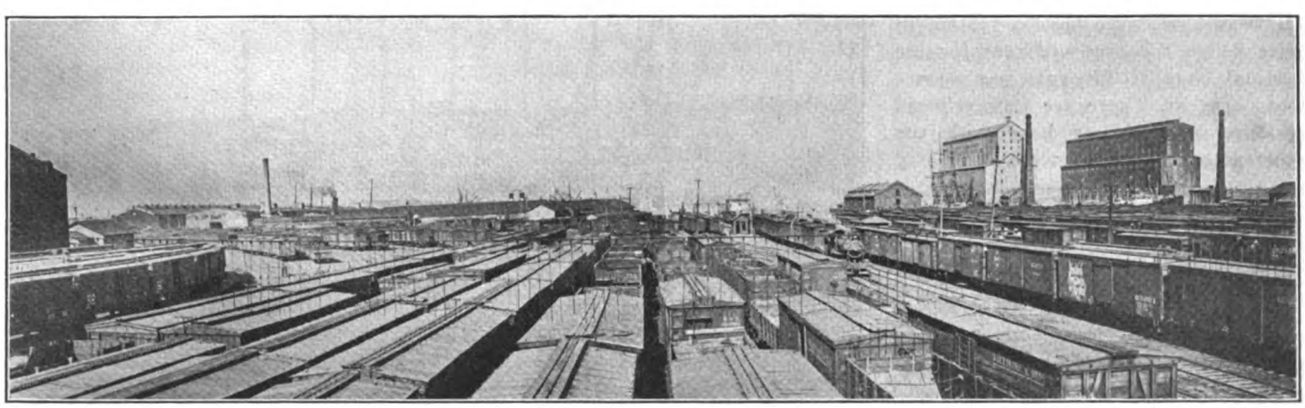
S. Vicari Co., Baltimore to Sama, Cuba.

Jos. R. Foard Co., Baltimore to Colon and Central America.

Lanasa & Goffe Importing Co., Baltimore to Jamaica.

What work has been done is only the beginning of what the city of Baltimore proposes to do for its waterfront, and this is one thing that will greatly help the Greater Baltimore committee movement for the general development of Baltimore. There is now available a new $5,000,000 loan, part of which will be used for the acquisition of property and the construction of a commercial thoroughfare around the south side, 106 ft. wide on a maximum grade of 2 per cent, which will make South Baltimore one of the most desirable locations for manufacturing and industrial works on the Atlantic coast. At intervals there will be projected modern piers to deep water with the best rail connections.

In East Baltimore there is now underway the construction of a public pier 500 ft. long and 150 ft. wide, which will be open to the shipping public, only a small dockage and



LOCUST POINT YARDS OF THE BALTIMORE & OHIO RAILROAD

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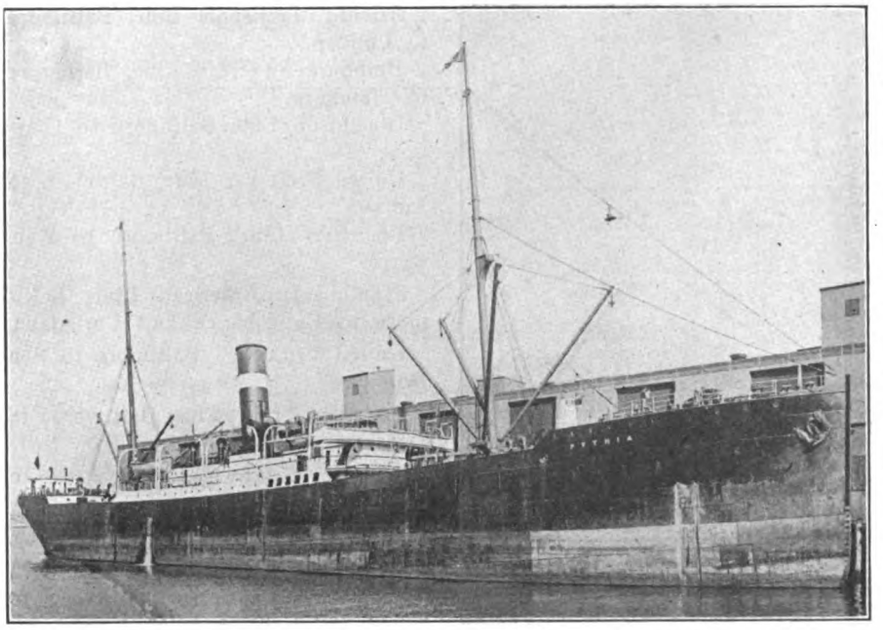


OCEAN LINER LOADING GENERAL MERCHANDISE AT BALTIMORE

wharfage charge being made by the city for the use of this pier.

It will be but a short time before work will be started on the larger piers providing a depth of water of 35 ft. The rapid stride shown makes these improvements necessary, and the people of this city are alive to the fact that they must provide for the rapidly growing trade. The completion of the Panama canal will tax our present piers to their limit and Baltimore is too wide awake in this day and generation not to look a few years ahead and place itself in a position to grasp this very important trade at the opening and not try to pick it up after it has gone to other ports.

What city can offer more than Baltimore to manufacturers is the argument made by the greater Baltimore committee. We have here thousands of acres on bold water with railroad connections, some of which the city owns and will sell for from $500 to $2,000 an acre. We have a system of piers which the city will rent for the nominal sum of 36 cents per square foot per year. There are four railroad systems that operate here with the shortest routes to the west.

Obituary

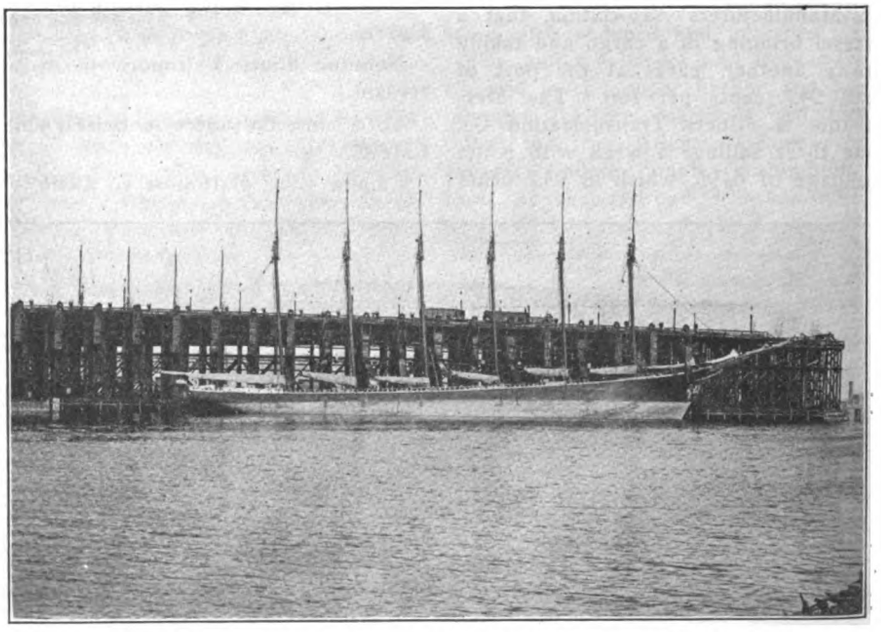
Capt. James Stone, supervising inspector of steam vessels, died at his home in Cleveland, on Nov. 23, of acute indigestion. His death was very sudden. He had worked all day in the office the day before and had gone to a church social during the evening and was apparently all right. In the night, however, he was acutely seized and died within a very few minutes.

Capt. Stone was born in Canada, in 1836, his family moving to Vermilion, O., two years later. He began sailing at the age of 17. At that time Capt. Alva Bradley, of Vermilion, was beginning to build up his large fleet of vessels, and it was natural that young Stone should seek employment from him. In fact, he remained with the Bradley fleet continuously for 37 years thereafter. Capt. Stone's early experiences, of course, were in sailing vessels and he was known from one end of the lakes to the other as one of the most experienced navigators that had ever sailed on the lakes. In fact, during all his long career as a navigator the underwriters were never called upon to pay a claim upon any vessel of which he was the master. He was appointed supervising inspector of steam vessels in 1898. He is survived by a widow, two sons and a daughter.

Joseph Kidd, the ship surveyor, died at his home in Duluth, on Nov. 16, at the age of 65 years. He came to this country about 25 years ago from Newcastle-on-Tyne. He entered the employ of the Cramps, at Philadelphia, upon arrival here, but went to Duluth, when Capt. Alex. McDougall established a shipyard there. Of late years he has been engaged in survey work for underwriters and vessel owners.

New Machinery for Owego

Babcock & Penton, engineers and naval architects,, have given contract to the American Ship Building Co. for new boilers, draft system, etc., for the steamer Owego, of the Union Steamboat Line. The boilers will be 14 ft. 6 in. diameter, 11 ft. 3 in. long and built for a working pressure of 170 lb. Incidentally, the shells are to be constructed of two plates only, eliminating the girth seam entirely, and the plates will be among the largest ever rolled in the United States. The draft system will be of positive heated type. Extensive improvements will also be made in the machinery and bunker arrangements. The work will be done at the Cleveland yard.



COAL PIER OF THE WESTERN MARYLAND RAILROAD AT BALTIMORE

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Sounding the Sea

By George Sherwood Hodgins

SPINNING all sorts of rounded stones on the sea beach was the way the late Lord Kelvin prepared himself for the great Cambridge mathematical examination. He and a friend occupied a great deal of their holiday at the sea-side in what seemed to be a very frivolous pastime, and it is needless to say friends were much concerned for Kelvin's success at the examination. The famous man of science, however, not only passed the university test but solved the problem of why a rapidly spinning top rises to the vertical position, or "sleeps", as boys are apt to express it. Kelvin worked out the mathematical demonstration of this intricate problem, and his spinning stones was the evidence of the practical proof to which he submitted his mathematical theory.

Lord Kelvin's mind had not only a very highly abstract mathematical turn, but it was also practically trained, as this incident proves. Another problem which he set himself to solve, resulted in the production of a very simple apparatus now used on ships everywhere for the purpose of taking accurate soundings, without stopping or even checking the speed of a ship. The apparatus shows that its inventor was possessed of great mathematical acumen, and also with practical knowledge and skill of a very high order. Nearly every trans-Atlantic passenger has had an opportunity of witnessing the use of Kelvin's method of sounding, by means of a specially prepared glass tube attached to the "lead".

What the Sounding Lead Is.

The sounding lead of today is really a cast iron sinker, slightly tapered toward the upper end, in which is embedded an iron rod, the whole weighing about 24 lb. To this is attached about a fathom of plaited hemp line, and this in turn is made fast to the loop at the end of a seven-strand steel wire, by which the sinker is lowered into the water. It may here be said that the lower end of the sinker is hollowed out, so as to form a small cavity into which soap is introduced. This is to enable the sinker to bring up a sample of the "bottom" which it touches. The composition of the bottom and the depth of water are charted in and about harbors and along the coast so that the captain of a ship may judge of his whereabouts when approaching land by the kind of bottom brought up, and the depth indicated at each cast of the lead.

What is called "Kelvin's chemical tube" is suitably encased in a brass receptacle, into which the water has access. It is fastened to the sounding line just above the sinker. This tube is made of glass, and is about ⅛ or 3-16 of an inch in diameter. The tube is 2 ft. long and is coated internally with chromate of silver, a reddish powder which adheres to the inner surface of the tube. The glass tube is sealed at one end by a small metal disc, which is held in place by a little metal top, similar to the old-fashioned percussion cap which was at one time used on shot guns. The cap is dipped in varnish or hot sealing wax and is pressed over the end of the glass, so that one end of the tube is stopped by an air-tight seal while the other is open. The sealed end is the upper one when the tube is in use.

Principle Based on Mathematics.

The tube thus scientifically made is the outcome of a thoroughly practical mind, but its use, though simple enough, involves the application of a principle which is based on mathematics, and is generally known as Boyle's or Mariotte's law. The law when stated is to the effect that the volume of a gas varies inversely as the pressure to which it is subjected. For example, gas occupying 1 cu. ft. of volume at a given pressure, will occupy one-half a cubic foot at twice the pressure. The little glass tube open at one end has its upper end tightly sealed. It is, of course, full of air when thrown into the sea and the water can only enter at the lower end. Water, like any other substance, possesses weight, and this weight increases with the depth. In this respect water is like a wall of a building. Each particle has weight of itself, and when piled one on top of another, the lower strata of water and the foundation of the wall bears all the weight of the mass above it. As water is a homogeneous body its weight at any depth is easily calculable when the weight of a given volume at the surface is known.

When the Kelvin internally coated tube is plunged into the sea and is carried downward by the sinker, water begins to enter at the open end, and as the tube continues to descend, the water passes in, in larger measure, compressing the imprisoned air above it. When the water has penetrated to half the length of the tube, the air pressure has doubled, the volume being half, according to Mariotte's law, and it is then resisting the inflow of water by a pressure of two atmospheres. The tube being 2 ft. long, we now have 1 ft. of length occupied by water, and one by air. In order to force the air 6 in. further up in the tube, it must sink twice the former distance and the pressure of the water then occuping 1½ ft. of the tube is balanced by compressed air occupying the upper ½ ft. of the tube.

In ordinary practice on ship board, it is not necessary to calculate the depth of water by the compression of the confined air. The result is conveniently got at by laying the tube on a scale with closed end at the top and then reading the number of fathoms indicated on the scale at the boundary between water and air when the tube was submerged at the greatest depth. A slight correction is made when the barometer stands at or above 29¾ in. The appropriate correction for different barometric pressures is given in a table, so that the work of the officer in charge consists in reading the scale, and applying the corrections when necessary. All this he does without having to work out his results mathematically.

Lord Kelvin's Practical Mind.

The formation of the boundary or line of demarkation between air and water in the tube, is as interesting as it is ingenious. It shows again the practical mind of Lord Kelvin. The tube is entirely coated inside by chromate of silver, which is a deep red-colored precipitate. As the salt water makes its way up the bore of the tube, a chemical reaction takes place by which chloride of silver is formed and also the soluble salt, sodium chromate. As the tube is brought to the surface, the expanding air in it forces out the water, laden with sodium chromate in solution, and the chloride of silver, a yellowish precipitate, also slightly soluble in salt water, in presence of organic matter, is partly washed out, leaving the glass comparatively clear where the water has lodged, while above it there remains the untouched red chromate of silver. The lower edge of this red precipitate marks the point on the scale which must be read. Stating

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the reaction in chemical language we have, chromate of silver, common salt and water combining to form chloride of silver, chromate of sodium and water. This is shown by the formula,

$$Ag_2\ Cr\ O_4 + Na\ Ce + H_2O = 2\ AgCl + Na_2\ CrO + H_2O.$$

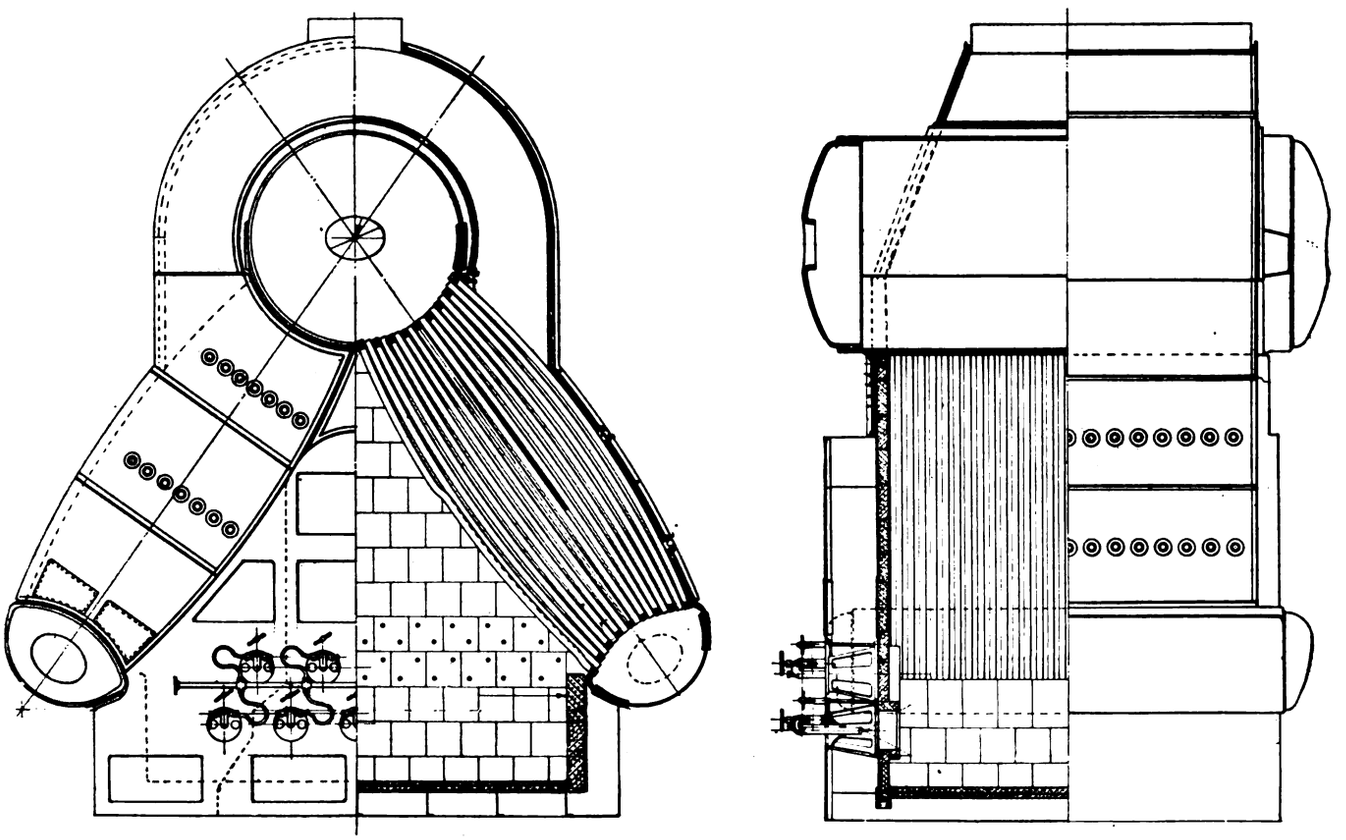
In this transformation, no gas is given off which could in any way increase the pressure of the air above the water. The result is, therefore, such that, if on lifting the tube out of the water, it be held vertically so that no moisture can trickle in on the red precipitate, a clearly marked record is secured which gives an accurate reading when applied to the scale.

In paying out the sounding wire, the reel is allowed to spin at such a rate as to permit of an approximately vertical drop of the sinker, and thus insures a ready "pick up" of the "bottom" by the soap at the lower end. The straight drop is, however, not necessary as far as the chemical tube is concerned, the vertical depth below the surface is measured by the water and air in the tube, obeying Mariotte's law, of volume and pressure, and the automatic record is rendered permanent by the chemical reaction which alters the color of the constituents of which the internal coating of the tube is composed.

The Mosher Water Tube Boiler

THE extended use of water-tube boilers in marine service in one of the important developments in steam power on shipboard. In this connection the Mosher Water Tube Boiler Co. have made an admirable record for themselves and in their various types of boilers have shown that they are adapted to all kinds of marine service, and for various kinds of fuel and methods of firing. Herewith is illustrated some of the forms of Mosher boilers which enables the advantages of this boiler to be more fully appreciated and its applicability to be seen. The general arrangement of the express type of the Mosher boiler is shown in Fig. 1, which type is adapted for use in fast yachts, torpedo boats, destroyers and is also adapted for cruisers and battleships, and is particularly for forced draft with either coal or oil fuel. Figs. 1 and 2 show a large boiler of this class, which is arranged for oil fuel, while Fig. 3 shows the same type of boiler adapted for burning coal.

As will be seen it consists of a large steam drum supported by two groups of slightly curved tubes, which connect it with two water drums with the furnace between. In order to secure the most complete contact of the gases of combustion with all parts of the tubes, the first row of tubes next to the furnace is so bent as to completely fill the spaces between the tubes of the second row for about two thirds of their length. This forms a tubular wall which deflects the gases upwards, then admitting them through the open spaces at the upper portion of this wall among the groups of tubes, then down around the center baffle and up among the outer portions of the group of tubes to the uptake at their upper ends, thus causing the tubes to be bathed their entire length by the hot gases. The tubes are all given a slight curvature so their upper ends point towards a row of hand holes in the upper portion of the steam drum. This admits of withdrawing and replacing



FIGS. 1 AND 2—SHOWING EXPRESS TYPE OF BOILER FITTED FOR BURNING OIL FUEL

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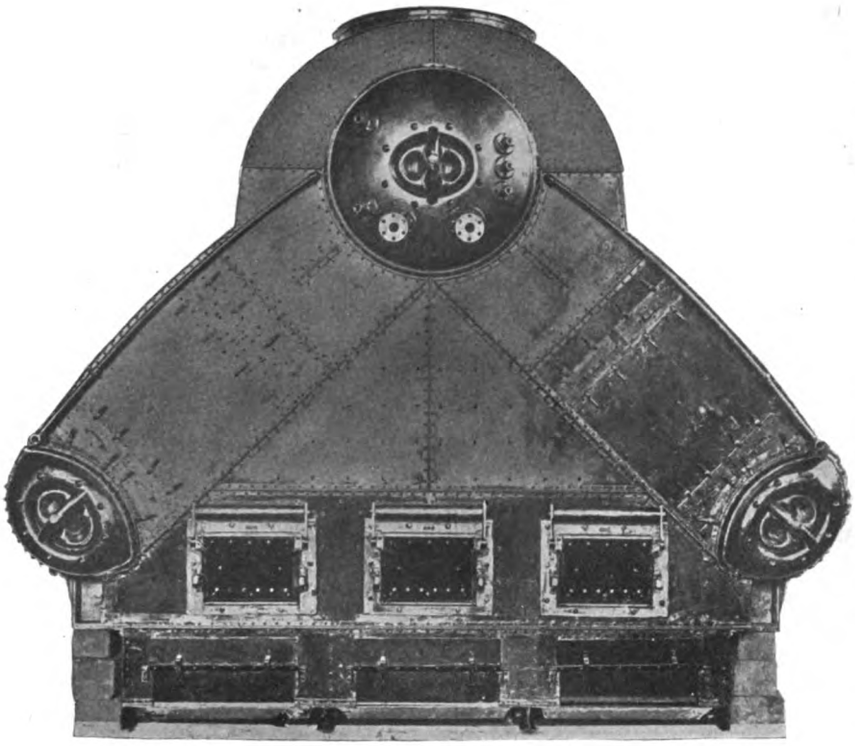


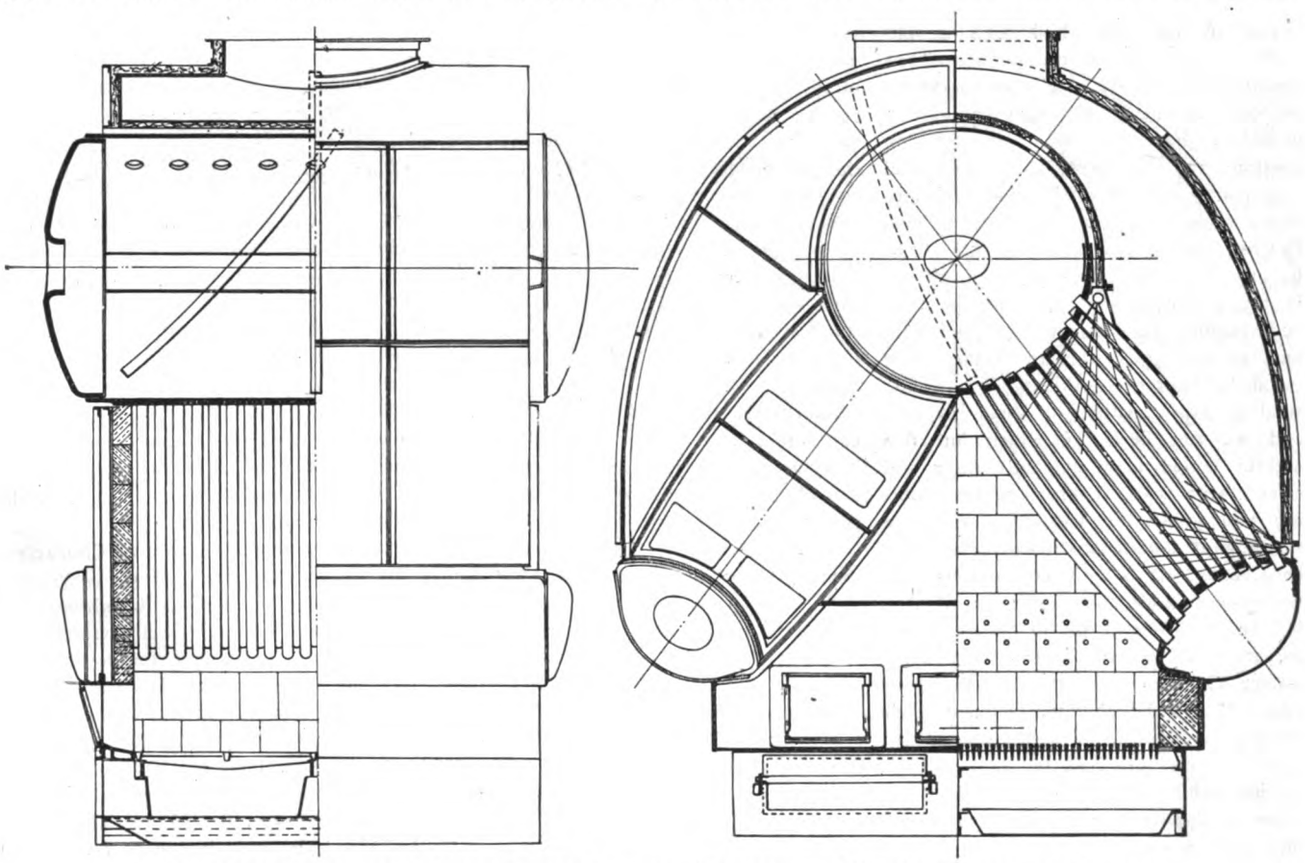
FIG. 3—EXPRESS TYPE OF BOILER FITTED FOR BURNING COAL

nearly one hundred tubes through each hand hole, thus reducing the number of handholes to a mere fraction of that required in other types of boilers, and enables any tube to be replaced without disturbing any other tubes.

These boilers are enclosed in a double steel casing made up of easily removed panels well reinforced with steel angles and lined with asbestos board and fire felt. The casing is provided with numerous cleaning doors through which all parts of the tubes can be reached. Besides soot blowing pipes are built into the casing which enables the soot to be blown off from the tubes by merely opening a steam valve.

The particular boiler shown is arranged for using oil fuel with a mechanical atomizing burner. The furnace is lined with special refractory fire brick, and there is an air space at the bottom, sides and at each end of the furnace, formed by the double casing which conducts heated air to the burners and also provides for admitting jets of air through the perforated firebrick on the sides and ends of the furnace which greatly assists in completing the combustion of the fuel.

Figs 4 and 5 represent the Mosher boiler as specially designed for service in all classes of commercial vessels where rugged construction and large water and steam capacity are especially desired. They are adapted to the service in which large Scotch boilers have formally been used and while retaining all the features which have brought the water tube boiler into prominence have drums of from 5 to 6 ft. in diameter



FIGS. 4 AND 5—SHOWING MOSHER BOILER SPECIALLY DESIGNED FOR USE IN COMMERCIAL VESSELS

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thereby admitting of a steam space of from 3 to 4 ft. above the normal water line with an admissible latitude in working height of water that will give about half an hour of water endurance after shutting off the feed, which is a very close approximation to the water duration of a Scotch boiler and many times in excess of the usual water tube boiler.

The tubes used in these boilers which are from 2, 2½ to 3 inches in diameter are so arranged that they may be removed without disturbing any portion of the casing or uptake, as by referring to the illustration it will be seen that the tubes may be withdrawn through the hand hole in the steam drum, which forms one of the special features of the Mosher boiler, until the lower end of the tube is free from the hole in the tube sheet when it may be drawn back into the steam drum and taken out through the man hole.

The drums are all large enough for a man to work easily in them and as all tubes are directly expanded in the drums, the work of inspection and cleaning is greatly simplified. There are no stayed surfaces, no cast parts, all pressure parts being of wrought steel, this material being furnished by the Carbon Steel Co.

The tubes are curved just sufficient to avoid expansion strains but may be cleaned with the same scrapers, brushes, etc., that are used for straight tubes, there being a large body of water at each end of every tube, good circulation is assured and one tube does not tend to rob another of its supply of water.

The great success of the Mosher boiler in all classes of naval vessels and numerous commercial installation demonstrates that they have long passed the experimental stage and have repeatedly shown their ability to meet all requirements.

OUR INFERIORITY AND DEPENDENCE IN SHIPPING

By William W. Bates, N. A.

WE had once a merchant marine of which we were proud. We had rivals, but not one of them had vessels superior to the American ship. In commerce and navigation we were perfectly independent. One of the principal objects of the union of the states had been accomplished. Our success on the ocean had convinced the world that republics might be well governed. No enemy could have predicted that one day our shipping prestige, our prospects of commercial supremacy, our national pride and ambition would have vanished like the mist. But we are now inferior on the ocean to any nation of the seventeen, shown in the accompanying table, which carry and conduct the commerce of the world and engross our foreign trade. We stand at the foot of this table, with the smallest vessel, either of steam or sail, and we run fleets of which but five eighths (number or tonnage) enter and clear "with cargo"—three-eighths coming and going "in ballast." A worse showing of a merchant marine has never been made. It is only comparable with the statesmanship that is responsible for it. In the column of "Tonnage used" we are credited with a very high figure—over 45 per cent of the British figure (for 1910) and double the tonnage which we used in 1856, when we had a foreign trade marine of 2,302,190 tons which carried commerce of nearly double the value of that in 1910. In his report for this year, we have the following statement from the commissioner of navigation:

Foreign Trade Tonnage.

"Our tonnage registered for 'foreign trade' now amounts to only 782,517 gross tons, the smallest amount in 78 years, except for the year 1898. When from this tonnage are subtracted vessels which have outlived their usefulness (lost class with the underwriters), but still retain their registers; vessels in trade between our Atlantic and Pacific coast ports by way of the isthmus of Tehuantepec, which by law are required to be registered, although cargoes on this route can be carried only by American ships; and the tonnage on the Yukon river, the remainder comprises little outside of steamers under the ocean-mail act of 1891 and the five trans-Pacific liners under the American flag. Last year American ships carried only 8.7 per cent of our exports and imports, the smallest percentage in our history, save in 1911." (A result of the war with Spain.)

Manifestly the "Yukon river" steamers ought not to be included in the "foreign trade" list of tonnage. Nor should "barges" without sail or steam power of their own—these cannot be sea-going vessels fit for "foreign trade," insurable for hull and cargo, as such must be. There are 75,971 tons of these "barges," and an amount for "Yukon steamers" of 34,071 tons, equal to 110,042 tons, that should be deducted, to find the amount of "foreign trade" tonnage—which would then be 676,475 tons, or less than the amount in 1804.

Only the shorter voyages could have been made by most of the vessels of our ill-conditioned and worn marine. It must have averaged 13 "round trips" in the year, to have carried a commerce of $260,800,278, or 8.7 per cent of our sea-borne foreign trade. And its vessels must have carried, mainly, only the cargoes of minimum value, and these at the lowest rates.

Comparison of values carried per ton (of vessel), 1910:

Foreign tonnage used in bringing imports	$42.42
American tonnage used in bringing imports	16.62
Foreign tonnage used in taking exports	45.06
American tonnage used in taking exports	12.85
Foreign tonnage, imports and exports combined	43.74
American tonnage, imports and exports combined	14.73

The foreign marine, composed of large ships, did best in exports. The American marine, with small, inferior ships, did best in imports.

But the American marine, owing to its impairment since 1860, has fallen much below the figure attained in its palmy days; while the foreign marine, owing to its improvement since 1860, has carried more value to the ton since then than it had done previously, as the following table illustrates:

The Advantage of Size and Character.

It remains to say a word concerning the advantage of size in freighting vessels. It is a law of vessel carriage, that large vessels can carry for lower rates than small ones. This law may be approximated thus: If a 1,000-ton vessel can carry freight for $8 per ton on a given voyage, then a 2,000-ton ship can carry it for $6.50 per ton; a 4,000-ton ship can carry it for $5 per ton, an 8,000-ton ship can carry it for $4 per ton, and gets, if she can, the "going rates," established by the smaller ones. Hence,

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Years.	1830.	1840.	1856.	1860.	1870.	1880.	1890.	1900.
American	$134	123.7	108.	83.9	88.9	75.6	49.7	31.6
Foreign	$108	57.5	64.4	102.4	112.6	83.7	98.2	85.1

American average, 1830 to 1860, inclusive, $112.8.
Foreign average, 1830 to 1860, inclusive, $83.1.
Foreign average, since 1860, $94.9, not including 1910.
American average, since 1860, $61.4, not including 1910.

Average Size of Vessels in the Fleets of Foreign Nations, Which Engross the Commerce of the United States; Tonnage of Each Fleet; With the Proportionate Tonnage of Each That Entered and Cleared with Cargoes in 1910.
(Ten small nations not included.)

Nations.	Average size of ship in each fleet.			Fleets with Cargo—Entered.		Fleets with Cargo—Cleared.	
	Tonnage used.	Steam, net tons.	Sail, net tons.	Steam, per cent.	Sail, per cent.	Steam, per cent.	Sail per cent.
Belgian	451,090	6,138	*2,074	93.66	100	100	*.....
German	4,053,737	4,015	1,663	81.11	49.50	93.05	76.50
Japanese	193,715	3,874	.....	100	.....	95.81	.....
Italian	824,183	3,739	1,137	92.61	73.88	100	96.13
Dutch	937,017	3,731	412	85.71	13.12	99.48	84.44
Greek	69,467	3,473	.....	100	.....	100	.....
Russian	99,942	3,245	905	98.12	13	100	100
Austrian	270,123	3,203	.....	95.69	.....	94.35	.....
French	897,154	3,109	2,034	95.85	49.69	99.72	76.50
Spanish	337,420	2,622	555	86.66	15.23	99.09	100
Danish	509,384	2,553	137	98	36.18	91.33	84.44
Brazilian	19,438	1,800	*52	100	.....	100	100
Uruguayan	28,401	1,693	.....	93.13	05.14	100	95.26
British	19,607,426	1,581	264	72.10	61.18	88.02	69.75
Cuban	207,900	1,534	150	99.45	.....	99.42	.....
Swedish	107,467	1,144	60	93.32	40.06	81.03	59.92
Norwegian	2,386,401	1,105	1,053	90.62	10.07	74.33	98.43
Total	31,000,265		*Only one.				
American	8,848,531	781	246	58.30	67.67	83.06	43.56
Ten others	122,036						
Grand total	39,970,832						

the larger vessels are the "money-makers."

The best fleet in the table was the Belgian—of steamers over 6,000 tons. The German fleet had ships next in size—over 4,000 tons—but it did not otherwise excel. The Norwegian fleet was third in tonnage, but its small vessels could have made but little money. The British fleet—of enormous tonnage—almost half of the "grand total"—was disappointing in other respects. Its steam carriage—below the German and French—was only better than American, which is the lowest in the table. Nor should it be overlooked, that the British ship has the best business protection given to any on the ocean—their discriminative "Lloyds" and other underwriters, and their more modern system of rebate contracts. British ships are given a character and a charter whether they have merits or not. The "friendless ship" is the American of today. She has a government that denies her rights and will not defend her from her enemies, let alone encourage her construction and employment.

A Shipping Measure Ready.

All loyal Americans will be glad to learn that there is now before congress for consideration a well-studied measure whose enactment is calculated to reanimate our shipping trade, to vindicate our commercial rights and to re-establish our equality among the nations.

The bill comprising this measure, is known as H. R. 4660, first session, sixty-second congress, introduced by Mr. Rucker, of Colorado. Its objects are these:

"To restore the merchant marine in the foreign trade, to overcome the disadvantages of American navigation, to make preference for American ships in export trade, to put the postal service by sea under general regulations, to put an end to foreign monopoly of our over-sea commerce, and to secure American independence on the ocean."

ACCIDENTS TO LAKE VESSELS

Naturally accidents to lake vessels are more frequent during fall months owing to heavier weather than usually prevails, and while they have been quite numerous during the month they have fortunately not been severe, the total losses being confined to the smaller class of craft. The heavy wind which prevailed during the early weeks of October blew quite a number of the larger craft on the beach, but did not inflict any severe injury. Probably the Centurion of the Cleveland-Cliffs fleet fared as badly as any during this blow, having been thrown against the breakwater at Ashtabula, making necessary the replacing of 24 plates on her port side.

The steamer Turret Cape ran ashore near Cove Island, Georgian Bay, and was abandoned by the owners as a constructive total loss. The steamer Raleigh in endeavoring to run from Port Colborne to Erie became disabled and was driven on the beach, pounding to pieces in the surf. Unfortunately in this accident three lives were lost. The Raleigh was not insured and the season ended without presenting any heavy claims upon the underwriters. Probably when all the losses are worked out it will be found that the underwriters have had on the whole a profitable season on the lakes. The list of accidents follows:

Date.	Name of Vessel.	Nature of Accident.	Location.
Nov. 5	S. O. Bge. No. 41	Ran aground	Near Green Island, Lake Erie.
.....	Str. J. M. Jenks	Arrived at Port Huron Nov. 6 with disabled air pump, having been caught in storm on Lake Huron	Lake Huron.
Nov. 6	Sch. Godfrey	Ran aground during gale; released; slightly injured	Niagara river.
Nov. 6	Sch. Exilda	Caught in strong gale and capsized; floated about in path of vessels	Lake St. Clair.
Nov. 7	Sch. John Mee	Lost her mizzen mast and sails and main top mast and sail in bad squall	Near Rogers City, Lake Huron.
Nov. 11	Str. City of Kalamazoo	Burned to water's edge; total loss	Manistee, Mich.
Nov. 12	Str. J. Q. Riddle	Blown ashore in heavy gale; mooring cable snapped and she dragged her anchors; some of her pipes burst owing to cold weather; released on Nov. 21 and docked; only three plates had to be taken off; slightly damaged	Buffalo.
Nov. 12	Str. Centurion	Tow line parted from tug which was pulling her in during heavy storm and she ran on the breakwater; released and docked at Ashtabula on Nov. 14; 24 plates on port side had to be taken off; ten days in dry dock	Ashtabula Harbor.
Nov. 12	Str. John J. McWilliams	Ran on mud bank in severe storm; released, uninjured	Near Chicago harbor lighthouse.

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Nov. 12	Fishing boat Eastern Star....	Foundered in storm; crew of five missing.....	Lake Michigan.
Nov. 12	Bge Delta	Tow line parted in storm between barge and Str. Pahlow; after 24-hour struggle in heavy sea managed to reach South Haven; crew suffered greatly from exposure to cold.....	Lake Michigan.
Nov. 12	Str. Zenith City	Ran aground in severe storm; released, uninjured.....	Encampment Isl., St. Mary's river.
Nov. 12	Str. Western Star.....	Wind lowered water in river considerably, causing steamer to run aground; No. 1 starboard tank punctured; stopped at Sault for temporary repairs; left Sault on Nov. 16 to be docked at Superior after unloading	Encampment Island, St. Mary's river.
Nov. 12	Str. S. J. Tilden.....	Torn from her moorings in severe storm and drifted into sunken piers	Erie, Pa.
Nov. 13	Str. Edward Hines.....	Cut in side by ice while being towed into harbor; leaked badly...	Duluth harbor.
.....	Rock Crusher Tonawanda ...	Ran ashore	Buffalo.
.....	Str. Bethlehem	Struck obstruction; leaked slightly; stopped at Port Huron.....	Near Bar Point, Lake Erie.
.....	Str. Lagonda	Struck; No. 1 tank punctured so that pumps could not keep her free; docked	Chicago, Ill.
Nov. 13	Str. D. G. Kerr.....	Had narrow escape in storm; ice became so thick on steamer that whistle broke off and steam escaped so fast that engines were almost stopped.....	Lake Superior.
.....	Str. Omega	Ran aground loaded with salt.....	Manistee, Mich.
.....	Str. Kongo	Ran aground; released Nov. 15.....	Dunkirk, N. Y.
Nov. 16	Barge Moore	Collided with Canadian steamer Crowe; taken to Reid's dry dock. (Moore was in tow of Str. Simon Langell).....	Abreast of Port Sanilac, Lake Huron.
Nov. 17	Sch. Lomie A. Burton.....	Wrecked in storm; crew rescued by life savers; cargo of lumber lost also	S. Manitou Island, Lake Michigan.
Nov. 17	C. F. Chief Wawatam.....	Ran aground near her dock in great snow storm; released herself on Nov. 18 apparently uninjured.....	Mackinaw City.
Nov. 17	Bge. Young	Broke from Str. Isabella Boyce in storm and sank; crew rescued; loaded with 870 tons of coal; total loss.....	Near Middle Island, Thunder bay.
Nov. 17	Str. L. L. Barth.....	Ran ashore in heavy gale; released on Nov. 20; lost three buckets off her wheel and leaked when released; towed to Sturgeon Bay for repairs	Espinore Island, Sault river.
Nov. 18	Sch. Monguagon	Sank while being towed to Walkerville; bow rests on Canadian shore and stern is submerged.....	Detroit river.
.....	Bge. Aurora	Lost her rudder in storm.....	———
.....	Str. J. A. McGean.....	Struck in channel in going to coal dock; No. 5 tank punctured; docked at Lorain on Nov. 19; five plates damaged.....	Sandusky, O.
.....	Str. Turret Cape.....	Ran ashore in storm; abandoned by owners as constructive total loss	Near Cove Island, Georgian bay.
.....	Str. D. Z. Norton.....	Struck lightly forward; broke a seacock; repaired at Lorain.....	Ballard Reef, Detroit river.
.....	Str. Albrecht	Ran hard aground, loaded with coal.....	Near Toledo, Lake Erie.
.....	Str. Edw. Smith.....	Ran ashore with cargo of lumber; jettisoned part of cargo and released herself	Long Point, Lake Erie.
.....	Sch. Iron City.....	In tow of Str. Edward Smith and also ran ashore; jettisoned part of cargo and was pulled off by Str. Smith.....	Long Point, Lake Erie.
.....	Sch. Minerva	Damaged on beach during storm.....	Near Ford river.
Nov. 20	Tug Columbia	Rudder became disabled in storm; picked up by tug C. H. Lamb and towed to Huron for repairs.....	Near Sandusky, Lake Erie.
Nov. 22	Str. Seneca	Steering gear became disabled and she ran ashore; released on Nov. 23 after lightering 240 tons; arrived at Manitowoc on Nov. 24 for repairs.....	Between North and South Manitou Islands, Lake Michigan.
Nov. 24	Str. G. J. Grammer.....	Fire broke out in coal bunkers; extinguished by tugs and a fuel lighter	Ashtabula, O.
.....	Str. Sonoma	Placed in dry dock at Port Arthur, Ont., on Nov. 24 for repairs to her wheel; one week in dry dock.....	———
Nov. 25	Bge. Edward Kelley.....	Broke away from tug in gale and ran ashore; crew saved; total loss	South of east breakwater, Port Colborne, Ont.
Nov. 27	Str. Juniata	Backed into Pittsburgh Coal Co.'s dock, damaging it to extent of about $700	Sault Ste. Marie, Mich.
.....	Str. D. O. Mills.....	Broke three buckets off her wheel coming down.....	———
.....	Bge. D. P. Dobbins.....	Became waterlogged; tug James Reid went to Alpena to get her and towed her to Port Huron.....	———
.....	Sand Str. C. W. Cadwell.....	Ran aground; released by wrecker Favorite on Nov. 27.....	Near Algonac, Mich.
Nov. 28	Str. W. F. Fitch.....	Two Hoover & Mason machines dropped on steamer when the M. Andrews caught her upper works in boom of unloading plant in passing; Fitch only slightly damaged; one rig pretty badly damaged.	Cleveland, O.
.....	Str. Rochester	While out in severe storm cabin windows and rail smashed, heavy seas flooded her cabins and cargo considerably damaged by water	Lake Superior.
Nov. 28	Str. Northern Queen.....	During severe storm, everything movable on steamer was swept overboard; also extra propeller blade which was lashed to deck; two plates on starboard side had to be replaced.....	Near Buffalo, Lake Erie.
Nov. 29	Str. W. K. Bixby.....	Rammed breakwater in storm and damaged several plates in her bow; misunderstanding of signals thought to have caused accident	Buffalo.
Nov. 30	Str. Umbria	Ran aground owing to low water.....	Toledo harbor.
Nov. 30	Bge. Maitland	Ran aground owing to low water.....	Toledo harbor.
Nov. 30	Str. Raleigh	Disabled in gale, rudder unshipped, and finally sank; total loss. Three lives lost.....	Near Buffalo.
.....	Str. Jay Gould.....	Boilers and planking slightly punctured by ice while entering Portage; held at Dollar Bay one week making repairs; left with pumps working on Nov. 30.....	Portage Lake.
Dec. 3	Str. Joseph Sellwood.....	Ran aground owing to low water; released.....	Opp. Life Saving Station, Buffalo.
Dec. 3	Str. G. A. Tomlinson.....	Ran aground owing to low water; released.....	Buffalo.
Dec. 5	Str. Niko	Rudder chains parted; towed to dock.....	Niagara river.
.....	Str. Wm. A. Paine.....	While unloading grain settled on bottom; docked at Ashtabula for damage sustained.....	Buffalo.

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Merchant Marine First; Navy Next

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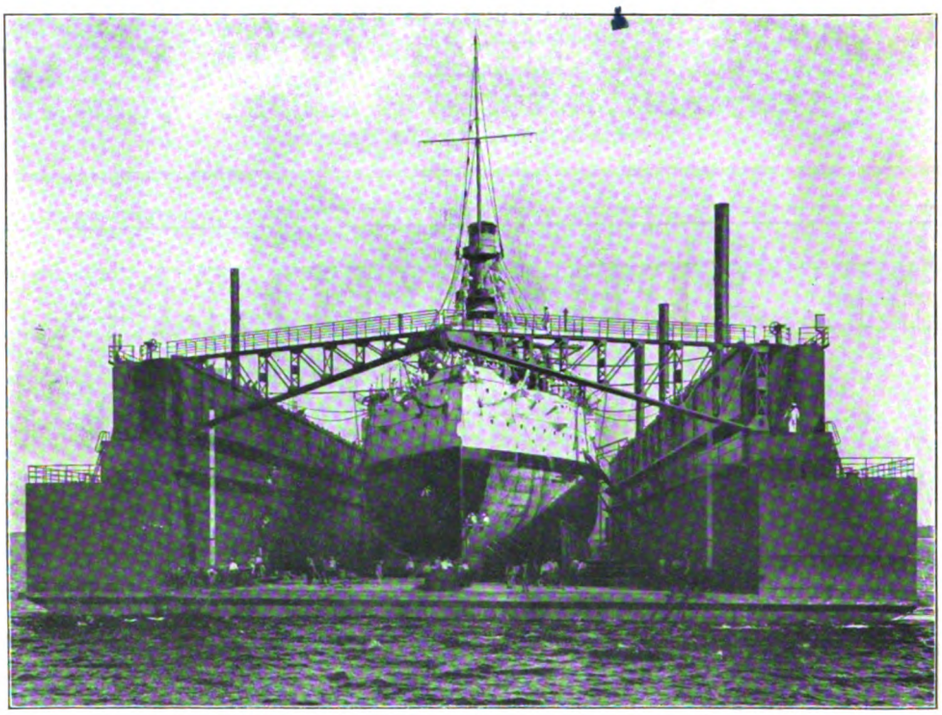
THE MARINE REVIEW

VOL. 41 CLEVELAND DECEMBER, 1911 NEW YORK No. 12

The U. S. Floating Dry Dock "Dewey," and the U. S. Battleship "Iowa" completely docked. This has to do with "WALL ROPE" to the extent that "WALL WALK LAID" HAWSERS were used in towing the Dock to the Philippines. This is admitted to be one of the greatest Naval achievements of the last decade. It was an undertaking requiring the selection of the best obtainable Manila Towing Hawsers.



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Uniform Thickness **Easily Cleaned** **Unexcelled for Strength**

Also FOX CORRUGATED FURNACES

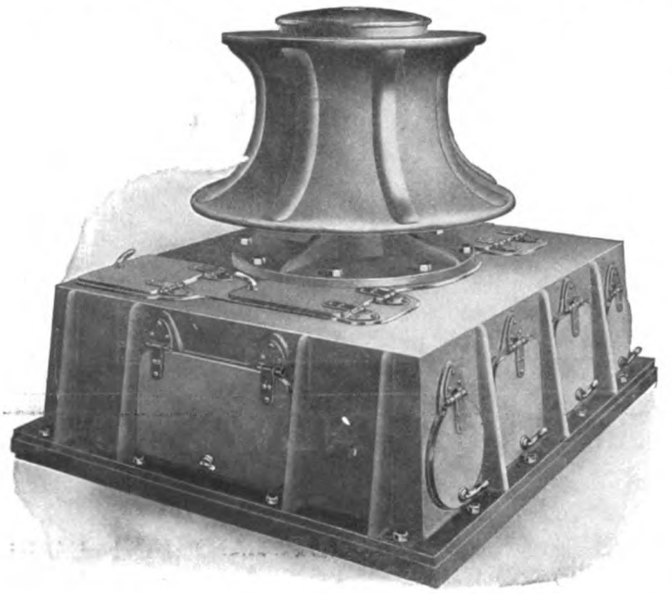
Manufactured by

THE CONTINENTAL IRON WORKS

West and Calyer Sts., BOROUGH OF BROOKLYN, NEW YORK

Near 10th and 23rd St. Ferries

THE "PROVIDENCE"



Steam Gypsey

is the standard for

TUG DECKS

Engines and gears entirely enclosed, but easily accessible through weather-tight doors.

Equally good for dock and warehouse service.

Williamson Bros. Co. **American Ship Windlass Co.**

PHILADELPHIA, PA.

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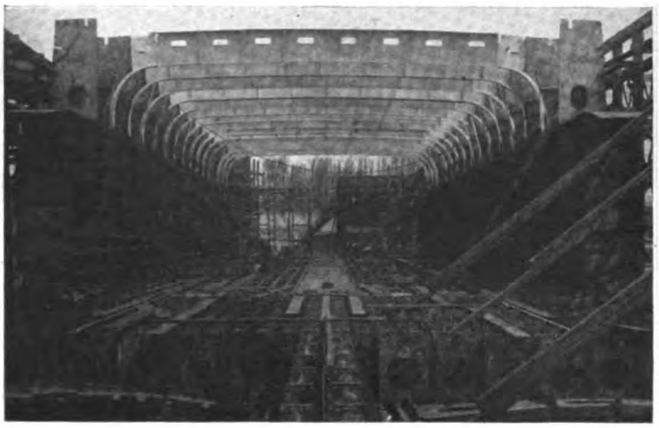
Isherwood System of Ship Construction

Suitable for all Types of Cargo and Passenger Vessels

Especially Advantageous for Great Lakes Ore Carriers, Oil Tankers and Shallow Draft Vessels

Increased Deadweight with Greater Strength



124 VESSELS BUILT AND BUILDING, REPRESENTING 511,000 GROSS REG. TONS

FOR PARTICULARS AND LICENSE TO BUILD APPLY

ZETLAND BUILDINGS **J. W. ISHERWOOD** MIDDLESBROUGH, ENG.

Licensors for Great Lakes of U. S. A. and Canada THE AMERICAN SHIPBUILDING CO., Cleveland, Ohio

Walker's Patent
SHIP-LOGS

CAUTION

All Rotators for Walker's Ship-Logs have the following Trade-Mark stamped on every Vane:

Rotators without this Trade-Mark should not be used.

THOS. WALKER & SON, Ltd., 58 Oxford St., BIRMINGHAM, ENG.

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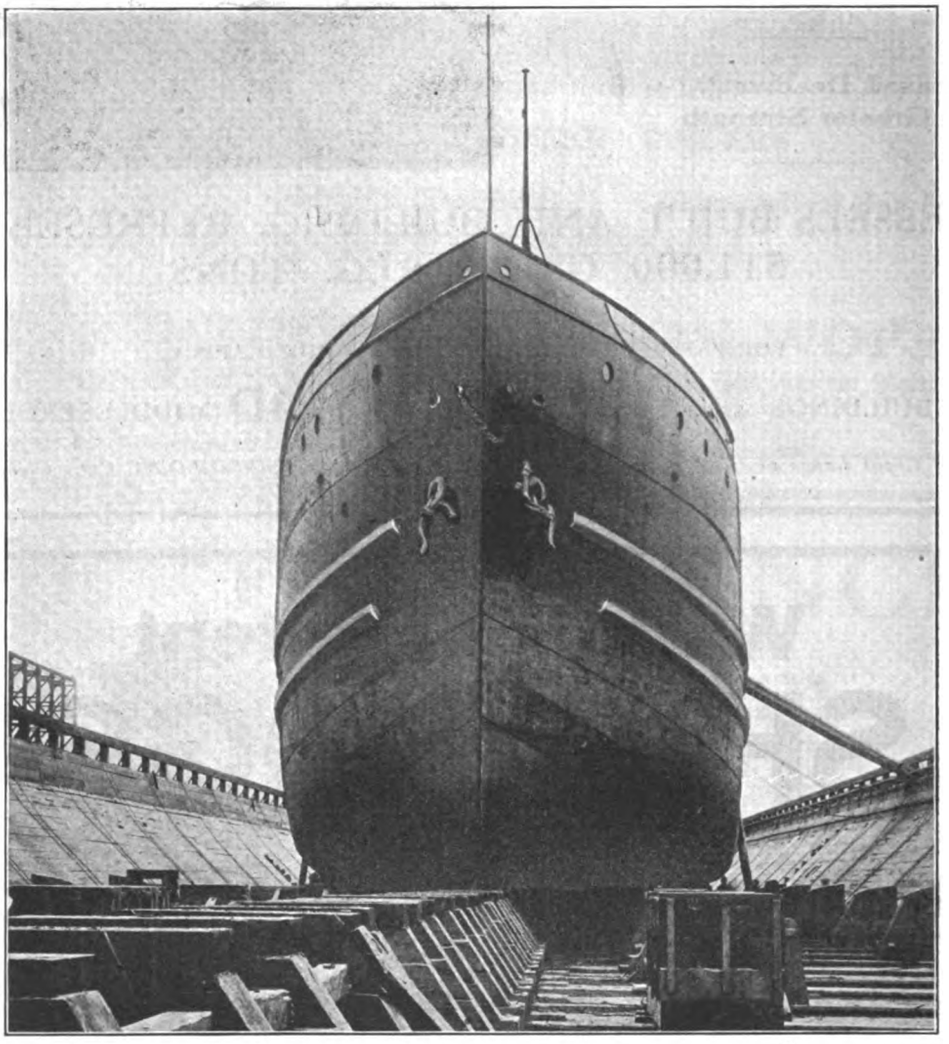
THE TOLEDO SHIPBUILDING COMPANY



Builders and Repairers of Ships and Engines

TOLEDO, OHIO

H. S. WILKINSON, President
CHARLES B. CALDER, Vice Pres. & Gen'l Mgr.

BURNS LYMAN SMITH, Treasurer
H. I. SHEPHERD, Sec'y & Ass't Treas

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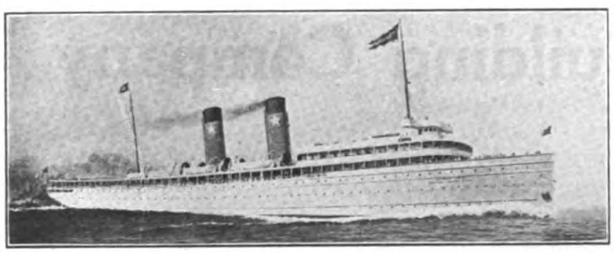
The American Ship Building Company

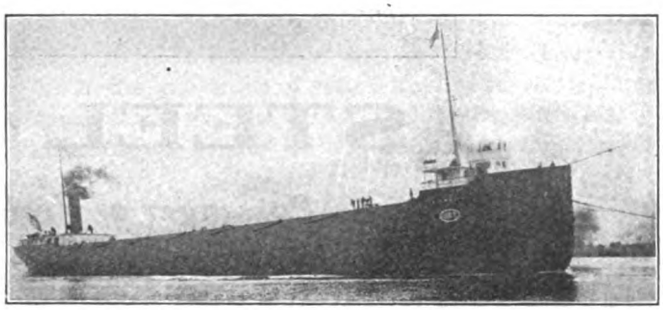


MAIN OFFICE
CLEVELAND
OHIO

Marine and Stationary Engines **STEEL SHIPS** **Boilers and Auxiliary Machinery**

Sole Agents for the Lakes for the Ellis & Eaves Induced Draft System, and "Brew's" patent flue blower, as applied to boilers.

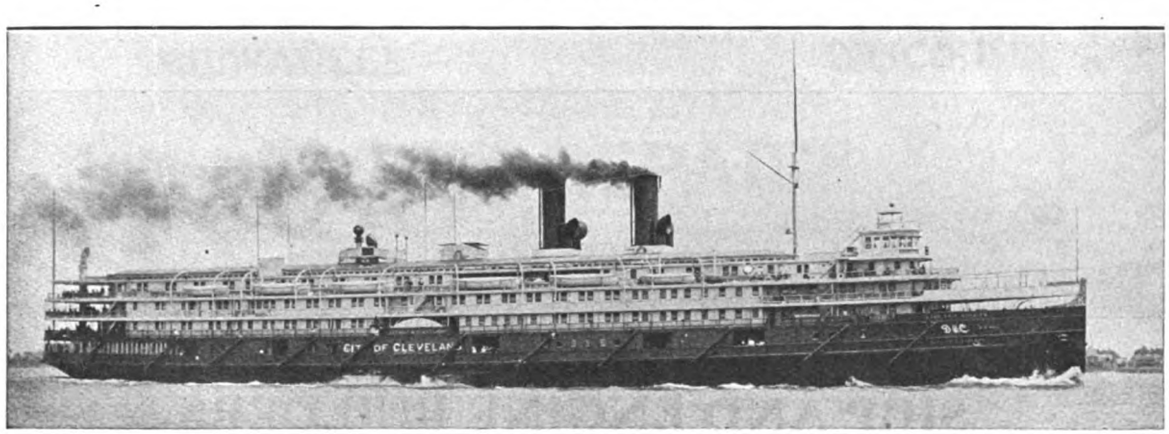
Works at CLEVELAND and LORAIN



M. E. Farr, Pres. and Treas. P. H. McMillan, Vice Pres. E. Ketcham, Secretary Frank Jeffrey, Gen. Supt. John D. Langell, Supt. of Dry Docks and Repairs

Detroit Shipbuilding Company

Established 1852



BUILDERS OF "CITY OF CLEVELAND"

Designers and builders of all types of

Freight and Passenger Steamers, Engines, Boilers and Auxiliary Machinery

Manufacturers of BRASS MARINE HARDWARE and BRASS SPECIALTIES.
Builders of Metallic Life Boats and Clark Patent Metallic Life Rafts.

Steel Shipbuilding Plant at Wyandotte, Michigan.
First-class equipment for making hull and machinery repairs

Dry Docks, Machinery Works, and General Offices foot of Orleans Street, DETROIT, MICH.

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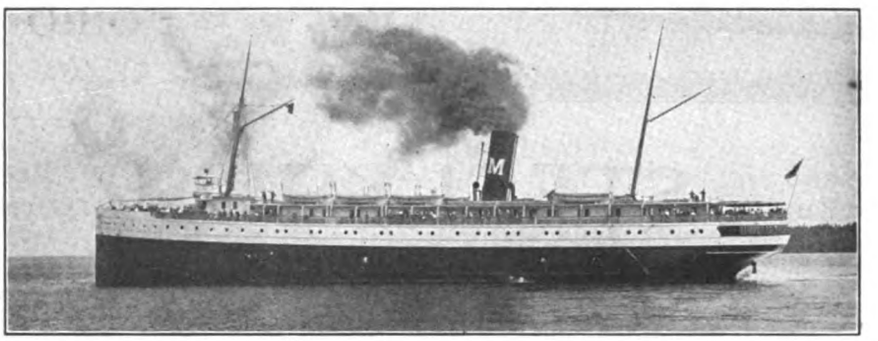
WM. L. BROWN, Pres. J. C. WALLACE, Vice Pres. R. C. WETMORE, Sec'y and Treas.
C. W. FREY, Ass't Treas. JOHN H. SMITH, Gen'l Supt.

Chicago Ship Building Company



STEEL SHIPS

Passenger or Freight—Any Size

Yards, Dry Docks and Repair Shops at South Chicago, Ill.

The Superior Ship Building Company

SUPERIOR, WISCONSIN

SHIP AND ENGINE BUILDERS

Dry Docks and Repairs of all kinds

Large stock of material always on hand for Repairing Wooden and Metal Ships

REPAIRING promptly attended to Night or Day

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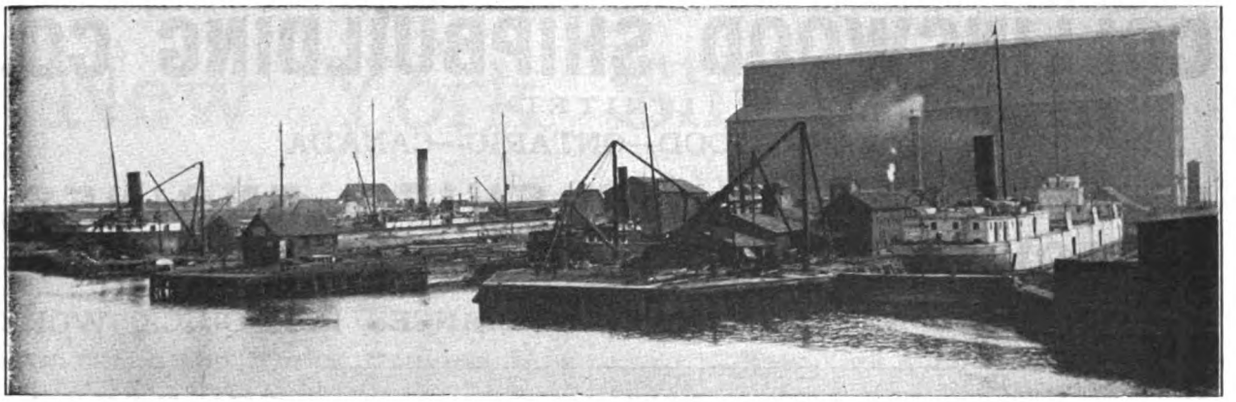

The Buffalo Dry Dock Company

BUFFALO, N. Y.

With our excellent equipment we are enabled to do all kinds of ship repairs at reasonable cost to the owners, whose patronage is solicited with the guarantee of satisfaction in all particulars.

We call attention to our facilities for the construction of new vessels of all kinds, particularly dredging outfits, tugs, scows, fuel lighters, etc., plans for which we will furnish on application together with specifications and estimates of cost.

EDWARD SMITH, President. EDWARD N. SMITH, Superintendent. WILLIAM KNIGHT, Ass't Sec'y and Treas.

Office Telephone, Bell, 4055 Seneca; 515 Frontier. President's Office Telephone, 2329 Seneca.
President's Residence Telephone, 209 Bryant. Ass't Sec'y's Telephone, 324 North
Superintendent's Telephone, Bryant 209.

Milwaukee Dry Dock Company

MILWAUKEE WISCONSIN

SHIP REPAIRS
OF ALL KINDS

We have two ship yards offering every facility for the repair of both steel and wooden vessels. South Yard Dock is 450 ft. long on keel blocks; 460 ft. over all; 60 ft. width of gate and 16 ft. over sill. West Yard Dock is 312 ft. on keel blocks; 45 ft. width of gate and 12 ft. over sill. Rudder pit in each dock. Electric light for night work.

MAIN OFFICE AT SOUTH YARD

Foot of Washington Street

Telephone Main 3

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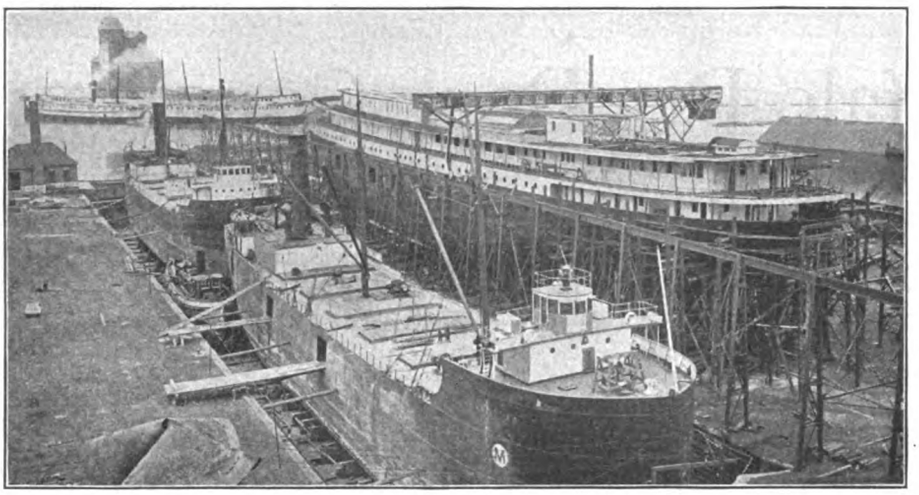
COLLINGWOOD SHIPBUILDING CO.

LIMITED

COLLINGWOOD—ONTARIO—CANADA

STEEL and WOODEN SHIPS, ENGINES, BOILERS, CASTINGS and FORGINGS

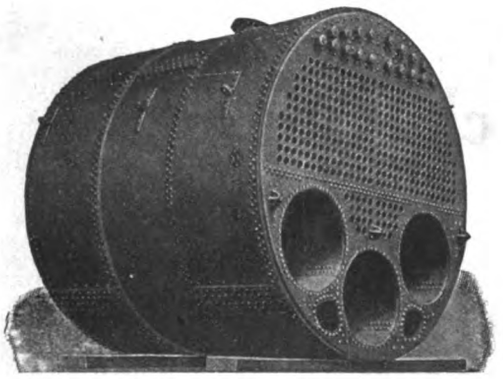
PLANT FITTED WITH MODERN APPLIANCES FOR QUICK WORK



DRY DOCKS and SHOPS

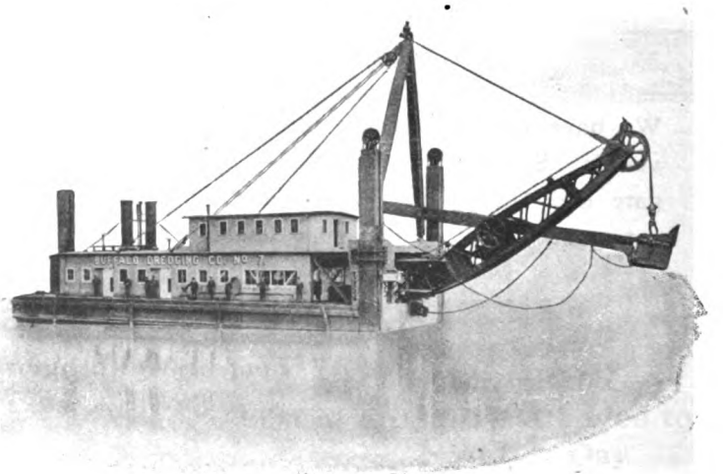
EQUIPPED TO OPERATE

DAY or NIGHT on REPAIRS



MODERN MARINE BOILERS and STEEL SHIP BUILDING

Tugs, Passenger Steamers and Special Construction



Write

Johnston Brothers

FERRYSBURG, MICHIGAN

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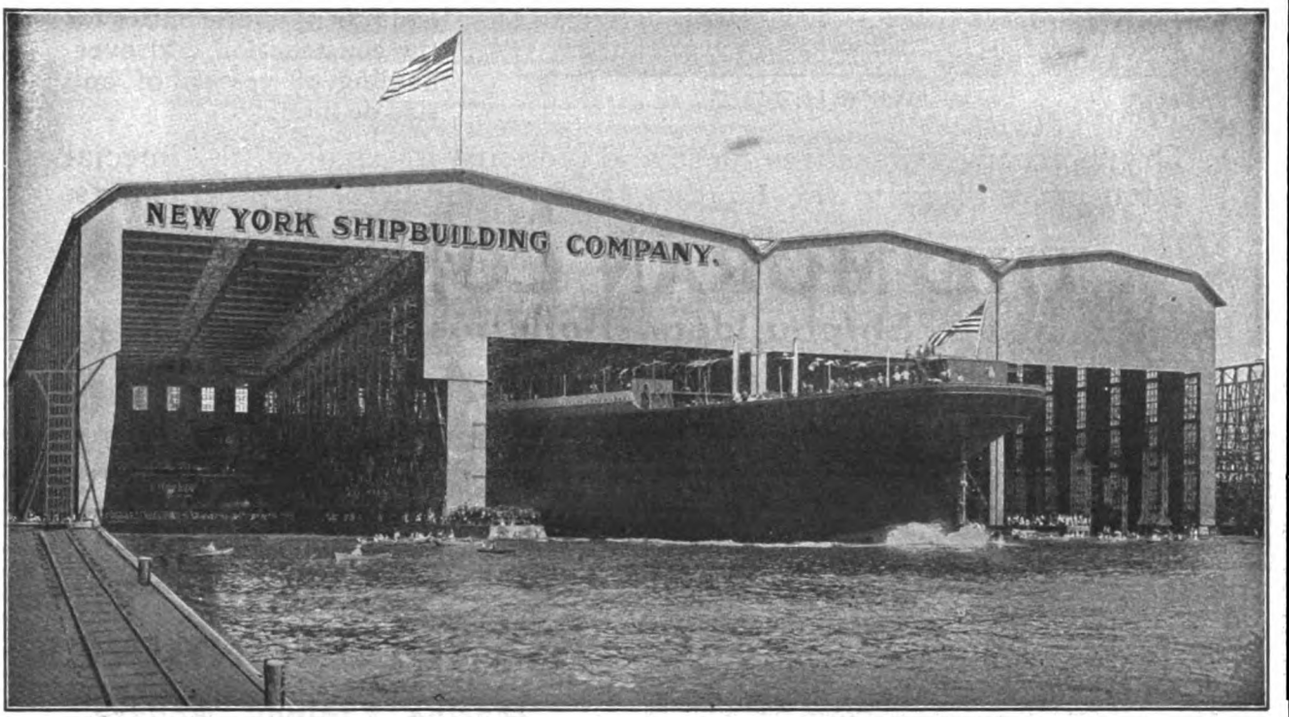
New York Shipbuilding Company

Main Office and Works, Camden, N. J. **New York Office, 12 Broadway**



Launch of "Mongolia," Pacific Mail S. S. Co., 615 feet long, 65 feet beam, 51 feet deep.

BUILDERS OF

SHIPS, ENGINES, BOILERS and HEAVY MACHINERY

BEST FACILITIES FOR REPAIR WORK

Pneumatic and Electric Tools; Ample wharfage accommodation.

One Hundred Ton Crane

Repairs done under Shelter

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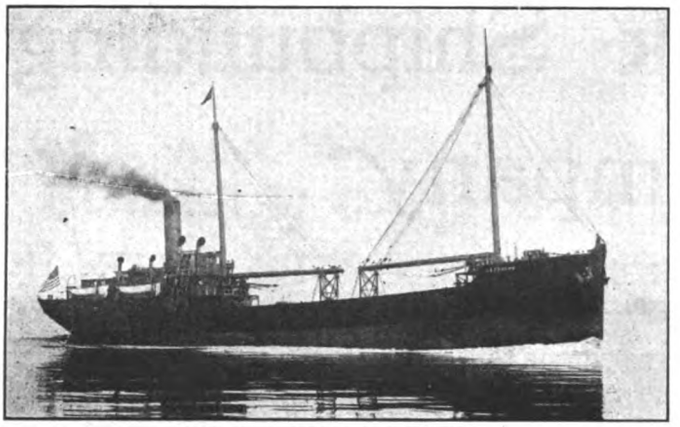


STEEL STEAMER LA TOUCHE

SHIPS

Designed, Built and Repaired

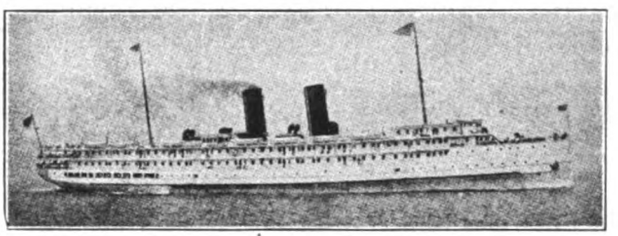
This plant has complete equipment and facilities for the construction and overhauling of vessels of any size or kind.

Drydock capacity assures speed and economy in repair work. Special attention is given to the building and installing of marine boilers.

THE MORAN COMPANY

Shipbuilders. Boilermakers

SEATTLE, U. S. A.



TURBINE STEAMSHIPS YALE AND HARVARD

PARSON'S MARINE TURBINES

Marine Engines, Boilers and Machinery of All Kinds

W. & A. FLETCHER CO.

Contractors for Vessels Complete.

HOBOKEN, N. J.

BATH IRON WORKS

LIMITED

BATH, MAINE

Shipbuilders and Engineers

Licensee for
Parsons Marine Turbines.
Normand Express Water Tube Boilers.

Particular Attention Given to
High Speed Requirements
Estimates Furnished.

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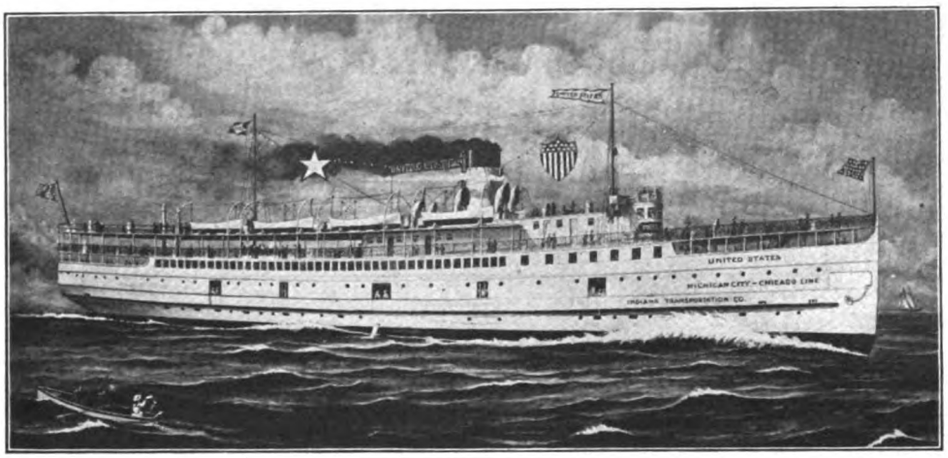
Manitowoc Shipbuilding & Dry Dock Co.

Manitowoc, Wis.

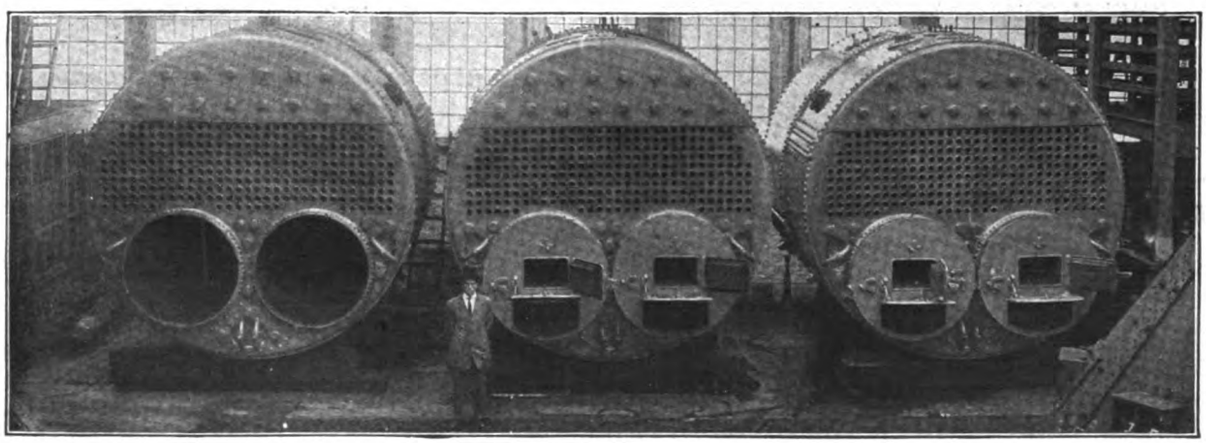


Specializing in the design and Construction of Passenger Boats, Fire Boats, Lighters, Tugs, Yachts, Dipper and Suction Dredges, etc. Engines of any size or type.

MANITOWOC

MARINE BOILERS

Best arrangement on Great Lakes for Economical Boiler Repairs



Manitowoc Boiler Works Company

Manitowoc, Wis.

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Tietjen & Lang Dry Dock Co.
Hoboken, N.J.

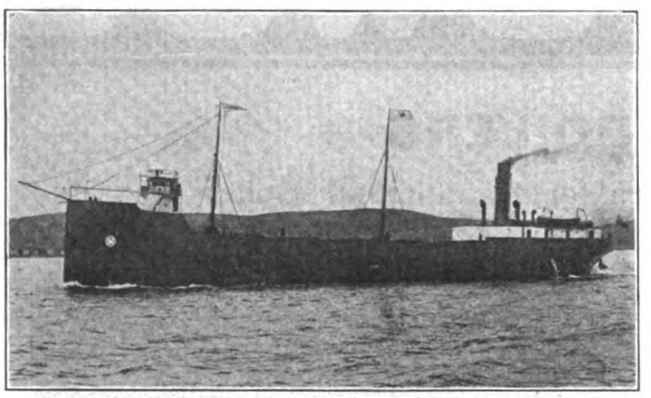
EIGHT DRY DOCKS

600, 800, 1,000, 1,200, 1,400, 1,800, 2,000, 10,000 TONS.

General Repairs on Wooden and Iron Vessels.

FT. OF 17th STREET

Telephone 700 Hoboken **HOBOKEN, N. J.**

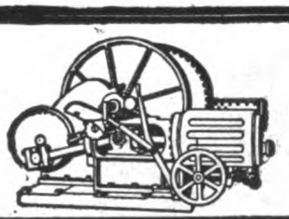


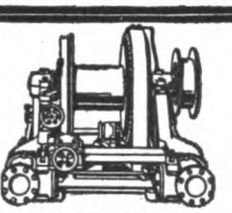
S. S. "ACADIAN" for WELLAND CANAL TRADE

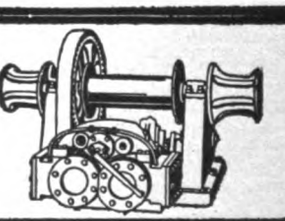
CODES—Scott's 10th Edition: Western Union
A. B. C. 5th Edition; Liebers.
TELEGRAMS—Clyde } Port Glasgow
TELEPHONE—No. 4 }

THE
CLYDE SHIPBUILDING & ENGINEERING COY.
LIMITED
CASTLE WORKS
PORT GLASGOW,
Scotland
SHIPBUILDERS, ENGINEERS, and BOILERMAKERS
SHIP and YACHT REPAIRERS

We construct up to date Package and Bulk Freight
STEAMERS for WELLAND CANAL TRADE







AUTOMATIC TOWING MACHINES
The Latest and the Best
Positively guaranteed

DOCKING ENGINES
Mooring Winches
Latest Improved Types

HOISTING ENGINES
Of all kinds and sizes and for all purposes especially for ship use

FOR THESE AND OTHER WELL KNOWN SPECIALTIES ADDRESS ALL INQUIRIES TO
THE CHASE MACHINE CO. ENGINEERS AND MACHINISTS CLEVELAND, O.

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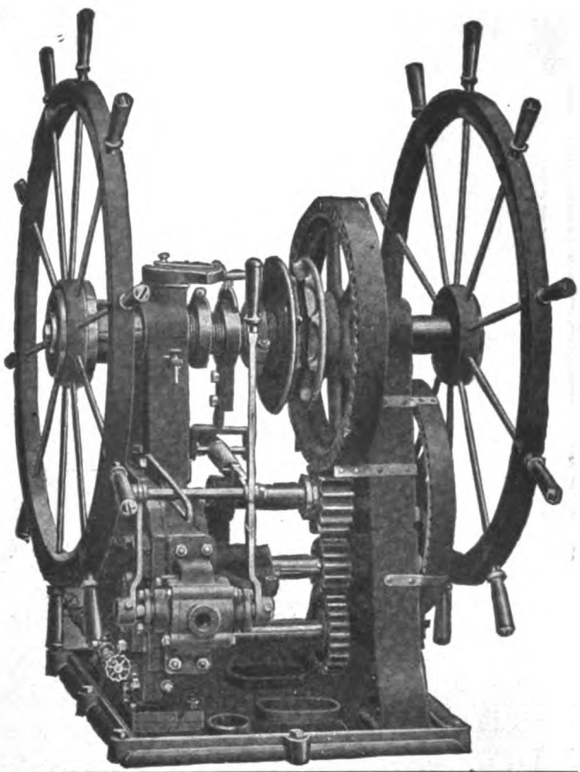
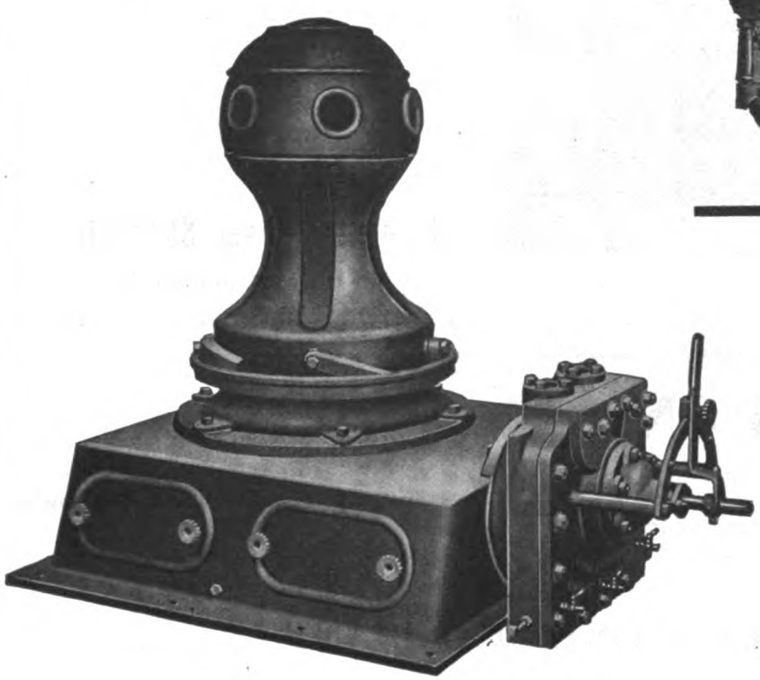
Let us Know Your Needs

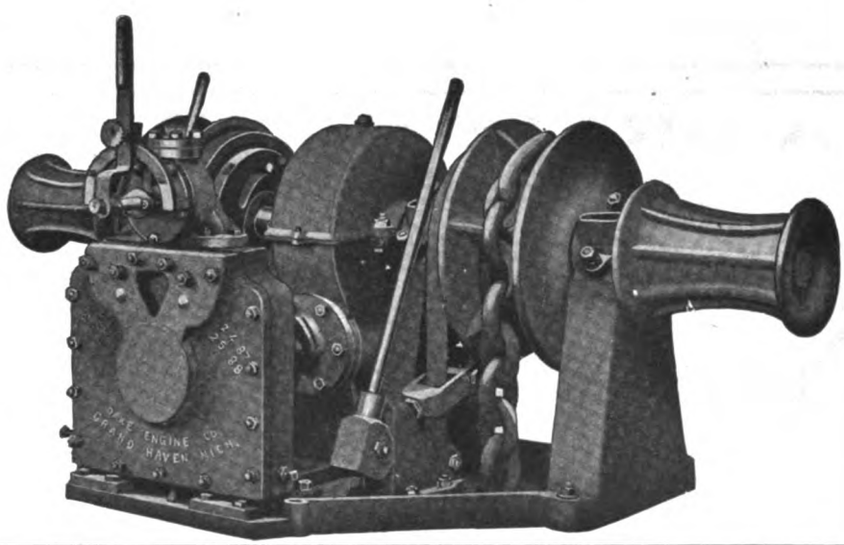
We manufacture Steering Gears, using either a single or double hand wheel as required. They are simple, durable and practically noiseless.





Boiler Testing Pumps, Chain Hoists, Derrick Grabs, Swinging Gears, Capstans, Windlasses, Deck Hoists, Engines direct connected to Centrifugal Pumps and Electric Dynamos.

We make all kinds of Brass and Gray Iron Castings.



DAKE ENGINE CO.

Grand Haven, Michigan

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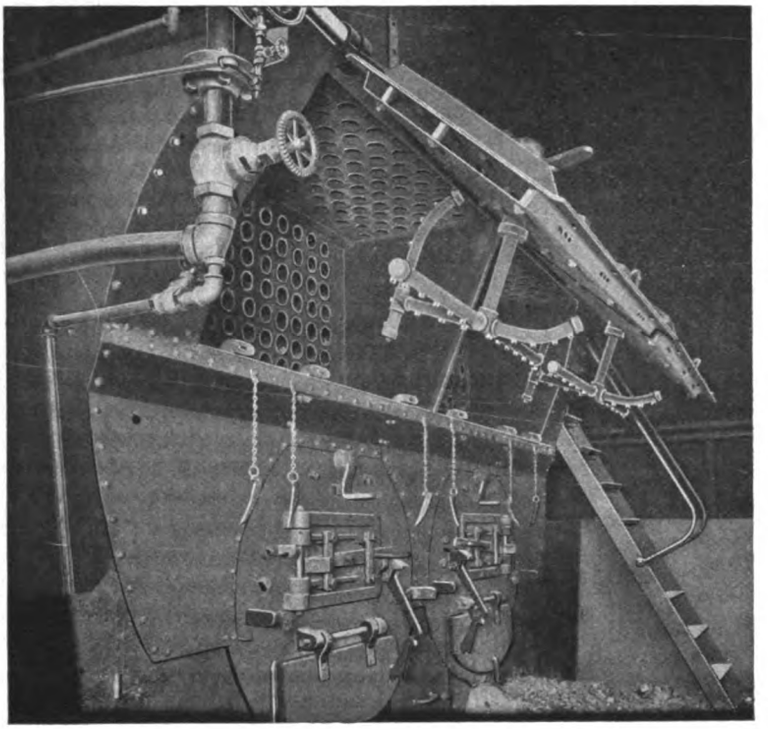
CLEAN BOILER FLUES



"Diamond" Blower as installed on Steamer "Hoover & Mason"

Cut down your fuel bills

by installing a

DIAMOND
Marine Soot Blower

This Blower economizes in every direction

It Doubles the Life of Your Boiler.
It Increases Its Capacity.
It Saves Enough Fuel in One Season to pay for itself several times over.

Clean flues save coal, and by the "Diamond" System the flues are kept clean every minute, whether in port or at sea. "Best I have ever used or seen" says the Engineer of the Steamer "Hoover & Mason."

Write for list of steamers equipped, and our new bulletin with complete description and diagrams.

"Diamond" Power Specialty Co.

76-78 First Street, DETROIT, MICH.

STOKERS ON STEAMSHIPS

Conserve bunker space because less coal is required to run the ship.

The saving in coal plus the revenue from the additional cargo carrying capacity plus the saving in labor is the net saving from an installation of American Stokers.

We will investigate your conditions and make guarantees. Our guarantees are as good as a Government Bond.

Write at once.

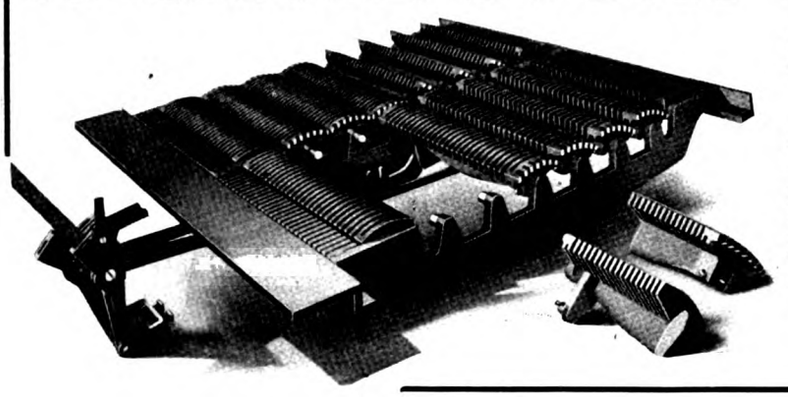
AMERICAN STOKER COMPANY

11 Broadway, New York City

American Stoker Co., Dooly Block, Salt Lake City, Utah
The American Stoker Company, Geo. J. Hagan, Pittsburgh, Pa.
W. W. Moore, Birmingham, Ala.
A. B. Nichols, Wade Building, Cleveland, O.
Standard Engineering Co., Ltd., Toronto, Can.
S. C. Alexander, Paris, Texas.
Underfeed Stoker Co., Ltd., London, Eng.
The American Stoker Co., A. Finkl Son Co., Chicago, Ill.

A GRATE STORY IN FOUR CHAPTERS

CHAPTER 1



Provident Steamship Co. Peavey Steamship Co.
Standard Steamship Co. Acme Steamship Co.

A. B. WOLVIN
General Manager.

Duluth, Minn., February 24, 1910

Superior Iron Works Co., Superior, Wisconsin.

Gentlemen:—Please furnish this company with the following: 6 sets of Superior shaking and dumping grates for our Steamers "James H. Hoyt," "George Peavey," "James H. Reed," same to be fitted under Babcock & Wilcox boilers. Size of each furnace 9 feet by 7 feet; price of grates as per quotation, delivered at boats, including grates, supporting bars, shaking levers and attachments. Yours very truly,

A. B. WOLVIN, Manager,
GP-AP By Gilbert Patterson, Fleet Engineer.

(To be continued)

SUPERIOR IRON WORKS CO.

SUPERIOR, WIS., U. S. A.

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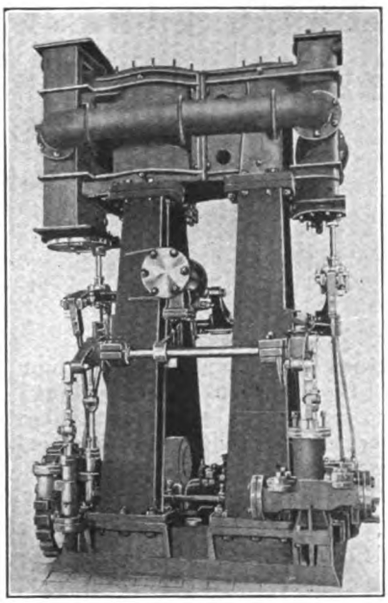
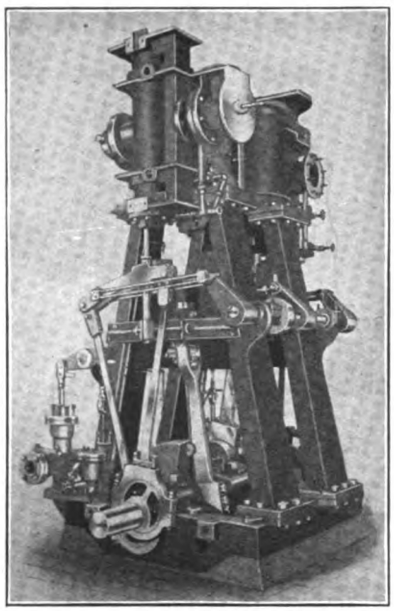


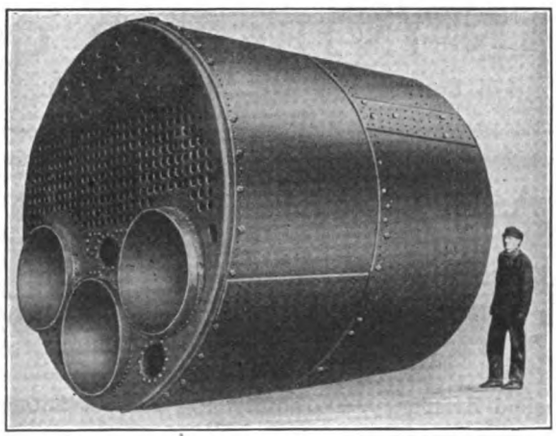
MARINE ENGINES AND BOILERS

of all sizes and types



Repair Department

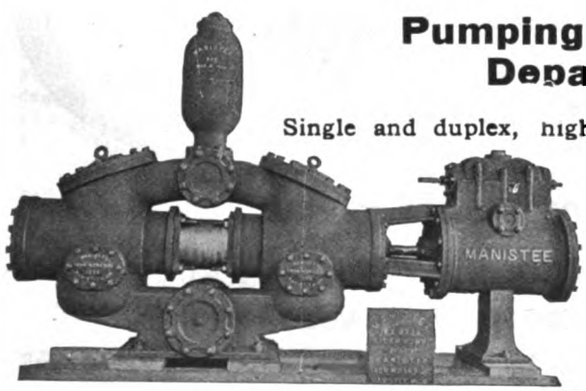
We run a General Repair Shop, doing work from the smallest to the largest, in Machine Shop, Foundry and Boiler Shop.



Steam Boiler Department

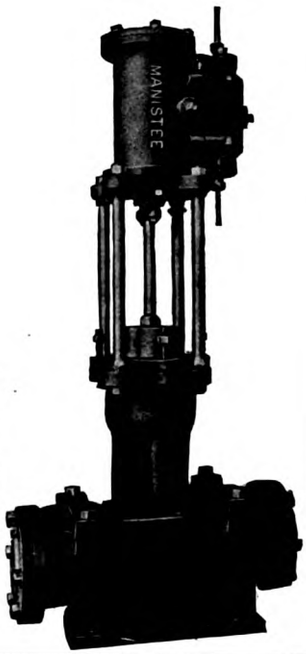
Tubular Boilers, Scotch Marine, Internally Fired Boilers, Locomotive Boilers and Special Riveted Steel Pipe, Smoke Stacks, Refuse Burners and Steel and Iron Tanks.

Manistee Iron Works Co.
MANISTEE, MICH.



Pumping Maohinery Department

Single and duplex, high duty compound and triple expansion crank and fly wheel pumping engines, Air Pumps, Boiler Feed Pumps, Fire Pumps, Belt and Electric Driven Pumps, Mine Pumps.



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U. S. Automatic Injectors

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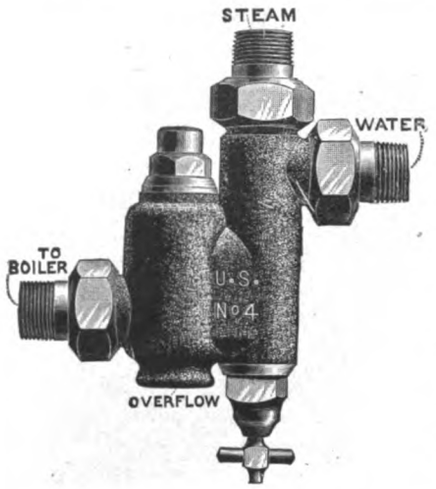

The scientific methods of doing business today demand that you "cut the corners"—save wherever possible—in operating expense, on shipboard or elsewhere.

U. S. Automatic Injectors save money in the operation of a boiler, by eliminating waste, as all heat not employed in forcing water into the boiler is saved by being returned to the boiler for repeated use.

Further, **U. S. Automatic Injectors** are easier to operate than any other—merely the turning on of the steam starts it working; it has wider range—starts at lower steam and works to higher steam; handles and feeds hotter water to the boiler; is automatic, with wide open suction, at lower steam; and with throttled suction it is automatic at any pressure sufficient to enable the Injector to get the water.

U. S. Automatic Injectors are simply constructed, do not get out of order, and no amount of jarring can break them; work equally well as lifters or non-lifters; give a genuine full 100 per cent. efficiency—another exclusive feature.

A card will bring our Catalog "D" and the "Engineer's Red Book"—a book every marine engineer should have handy at all times. Write for them—not some day—NOW.

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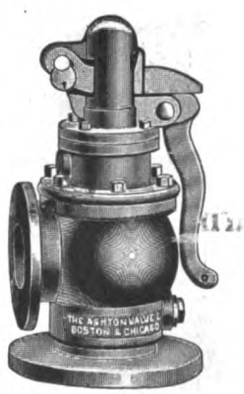
Pop Safety Valves and Steam Gages

Guaranteed to give
Unequalled Efficiency, Durability and Perfect Satisfaction.



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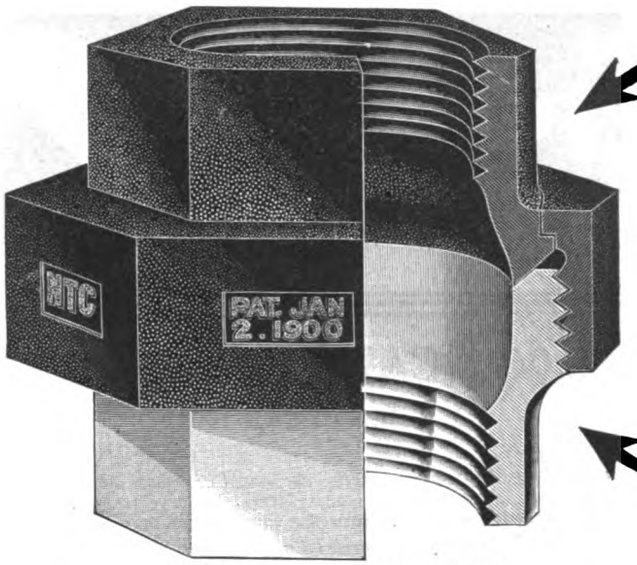

"Kewanee" Unions Replace All Leaky Unions

"The Union With No Inserted Parts"

¶ Prejudice for or against the use of an article of any kind is largely a matter of habit.
¶ Our representatives frequently meet, as a kind of argument against trying the "*Kewanee*" *Union*, something like this: "Well, you see we have always used an all brass (or malleable) union," as the case may be, as though that settled it.
¶ Sometimes the coming of a new Foreman, Superintendent or other mechanical man, who has used "*Kewanee*" *Unions* elsewhere, brings in a new point of view.
¶ For example: One of our representatives recently called upon a large manufacturer of Ice Making Machinery, and the Superintendent said:

"They have always used all brass unions here, but I know what the "Kewanee" Union is, and have recommended that "Kewanee" Unions replace all leaky unions throughout the plant."

¶ There seemed to have been a goodly number of 'leaky unions,' for the Superintendent entered a stock order for various sizes and kinds of "*Kewanee*" *Unions*.
¶ The reason why "*Kewanee*" *Unions* are satisfactory is epitomized below:

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(d) Solid, three piece construction—No Inserted Parts.
(e) Easily disconnected—No Force Required.

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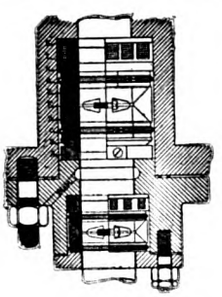

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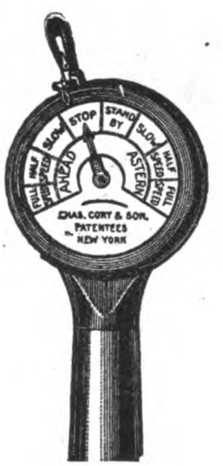

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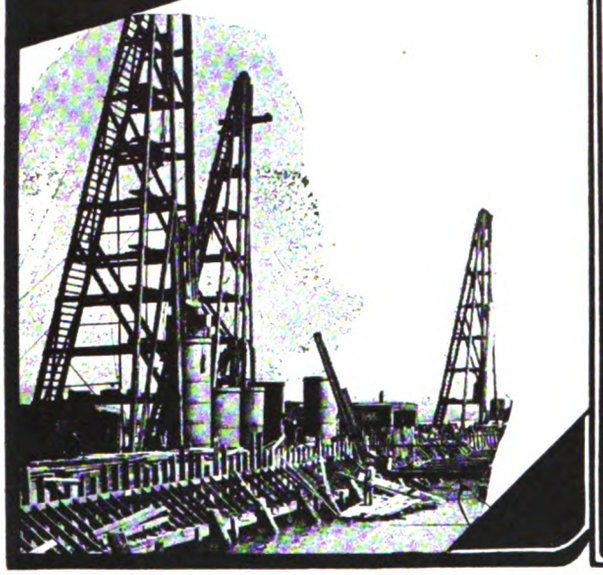

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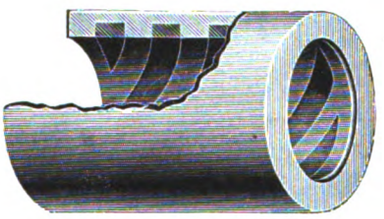

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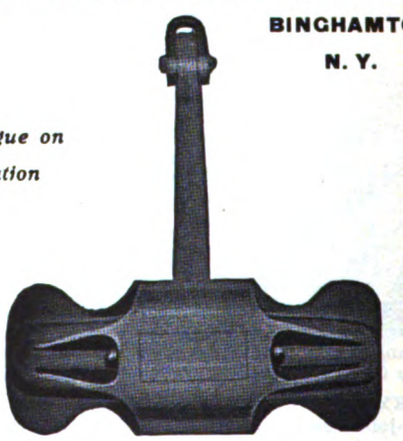

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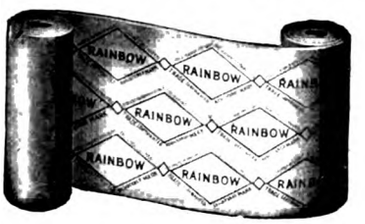

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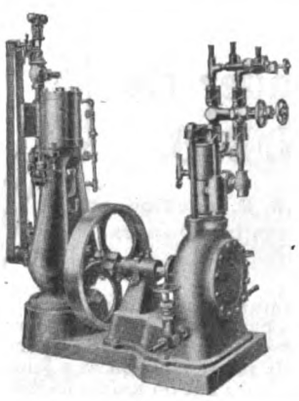

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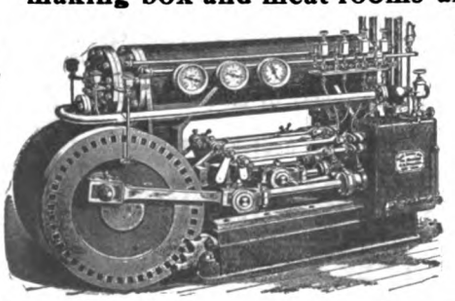

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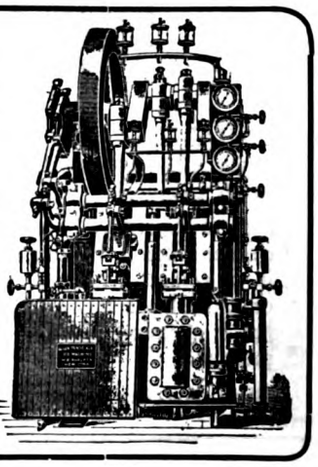

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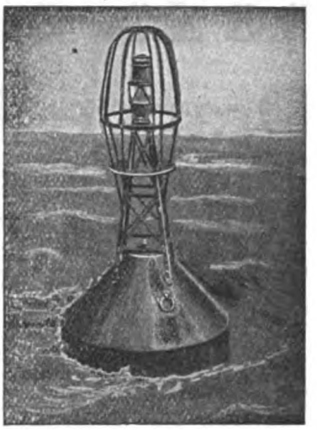

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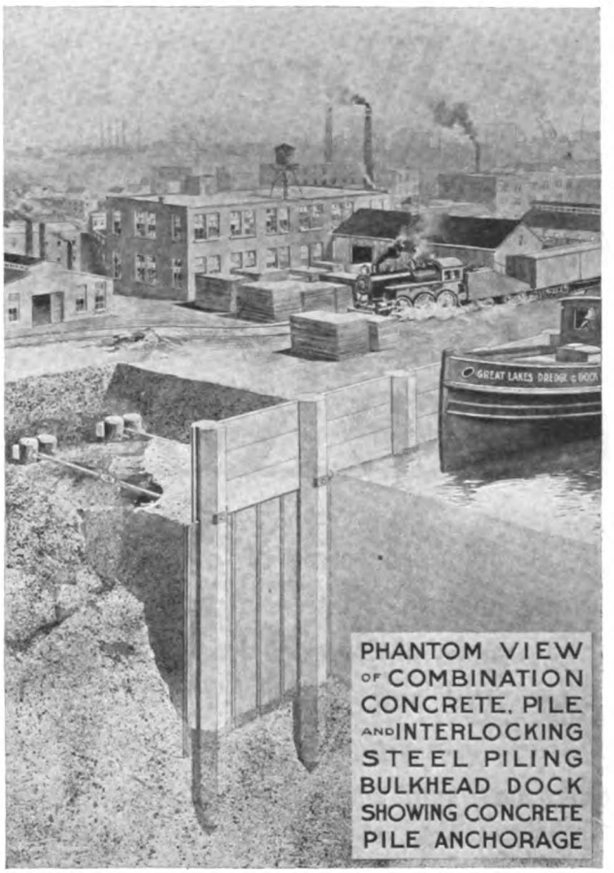

PHANTOM VIEW OF COMBINATION CONCRETE, PILE AND INTERLOCKING STEEL PILING BULKHEAD DOCK SHOWING CONCRETE PILE ANCHORAGE

This company has developed a

Permanent Bulkhead Dock Construction

that has a wide range of application.

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¶ Half sections of interlocking steel sheet piling are cast in two sides of each concrete pile. These steel pile sections extend from 1 ft. below low water to a penetration of about 4 ft. in the soil. Steel sheet piling is driven between the concrete piles to interlock with the steel sections in the latter. This interlock assists in the anchorage of the dock.

¶ Channels are cast in the concrete piles from the top of steel piling to the top of the dock. Cast concrete slabs placed in these grooves form the upper part of the bulkhead.

¶ We are prepared to design and install this permanent construction to suit local conditions anywhere.

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We are operating in all the harbors of the Great Lakes with offices in Chicago, Cleveland, Duluth, Sault Ste Marie, Gary, Buffalo, and Amherstburg, Ontario, Canada. Also on the New England coast, with an office in Boston.

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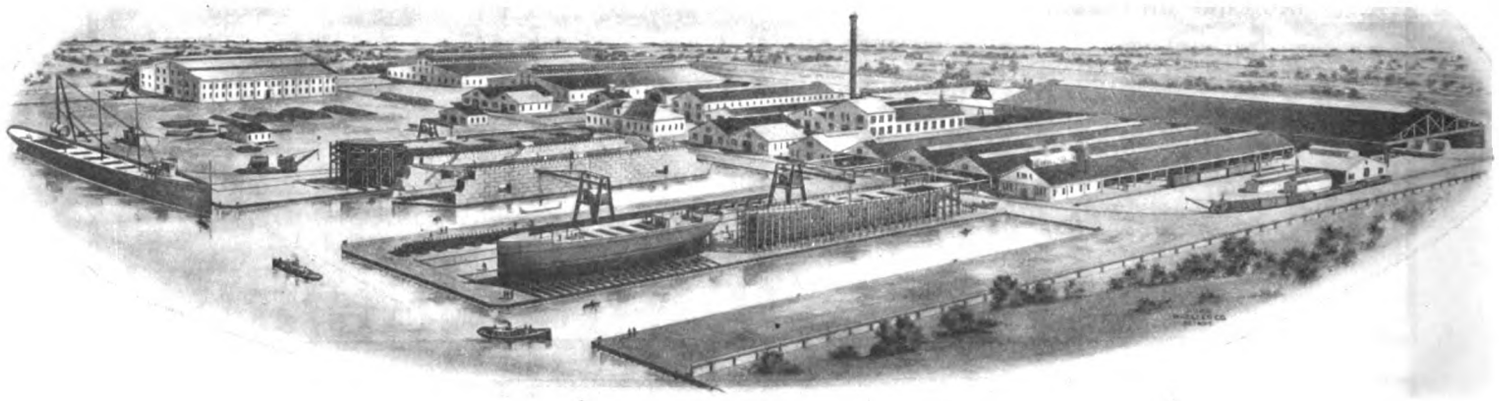

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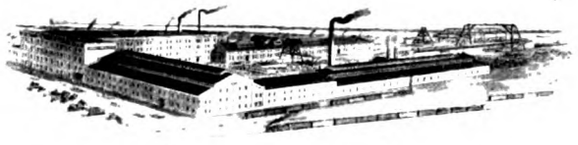

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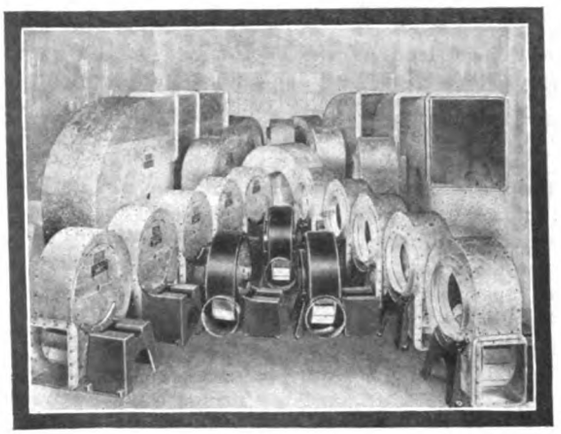

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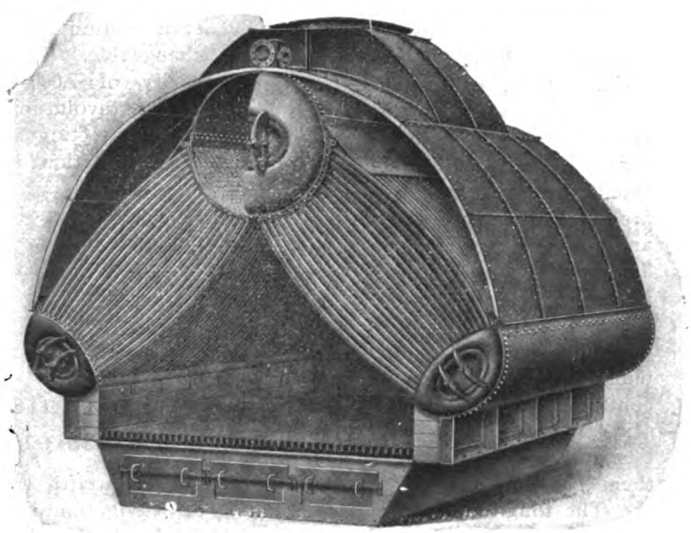

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Floating Dry Dock at Toronto

The Polson Iron Works, Toronto, is busily engaged upon the new floating dry dock which it is building under guarantee of a 3 per cent bonus from the Dominion government annually for 20 years on a capital investment of $900,000. The dock is ultimately to be of three sections, having a total length of 600 ft. and a lifting capacity of 9,000 tons, though for the present only two sections will be completed. These two sections will be 150 x 100 ft., having an overall length of 336 ft. and a lifting capacity of 4,500 tons. The dry dock is of the "U" shaped section and each 150-ft. part is divided transversely by two water-tight bulkheads spaced 50 ft. apart. These bulkheads are fitted intercostally between the three longitudinal bulkheads which are run continuously from end to end, the center being non-water-tight and the side ones, at 20 ft. from the center line, being water tight. These bulkheads are composed of ⅜-in. plating, 5 x 3 x ⅜-in. vertical stiffeners spaced 30 in. apart, and 5 x 3 x ⅜-in. horizontal stiffeners spaced about 7 ft. apart, and shell and deck angles of 3½ x 3½ x ⅜ in.

The framing consists of both longitudinal and transverse systems, the former being carried out between the wing bulkheads in the center and the latter outside the wing bulkheads and on the walls. Solid floors are fitted transversely every 10 ft. between the longitudinal bulkheads, and consist of ⅜-in. plating, with connecting angles of 3 x 3 x ⅜ in. and vertical stiffeners of 5 x 3 x ⅜ in. spaced 30 in. apart. Between these solid floors are fitted the longitudinal frames which are 6 x 3½ x ⅜ in. on the bottom and 12 x 25 in. channel at the top. The former are fitted intercostally between the solid floors, but the latter run continuously from bulkhead to bulkhead. This longitudinal system of framing is completed by a continuous series of lattice work of 4 x 4 x ⅜-in. angles with ⅜-in. cross ties and brackets securely connecting them to frames and vertical stiffeners. The longitudinal framing amounts to a non-watertight center bulkhead, two side wing bulkheads, both watertight, and 14 rows of frames and bracings. The transverse framing consists of a series of lattice work frames opposite every solid floor of 6 x 3½ x ⅜-in. angle frames, ⅜-in. brackets and 4 x 4 x ⅜-in. bracings. The side frames of outer and inner walls extend from top to bottom continuously, and have beams securely bracketed to them about every 7 ft. The intermediate frames are fitted between each solid floor, spaced 30 in. and extend from wing bulkhead to top and are of 6 x 3½ x ⅜-in. angles, with ⅜-in. brackets connecting beams and stanchions.

The bottom plating is 7-16 in., worked transversely in way of longitudinal framing at center, and longitudinally in way of transverse framing at sides. The outer wall is ⅜-in. plating with top and bottom strakes of 7-16 in. The inside wall is of ⅜-in. plating and the top is 7-16. The deck plating is ⅜ in., worked in the same manner as the bottom plating in connection with the framing. The corner angles at the deck, top and bilge are 4 x 4½ in. All shell landings will be joggled and linears dispensed with. The end plating is ⅜ in., and is connected to deck and bottom by 4 x 4 x ⅜-in. angles with 5 x 3 x ⅜-in. vertical stiffeners spaced 30 in., and horizontal stiffeners of 5 x 3 x ⅜ in. The gangways are fitted in each section in each side; the opening being 20 x 15 ft., with plating ⅜ in., and connecting angles 3 x 3 x ⅜ in. The rivets in the whole construction are ¾ in. in diameter, the plate landings being double riveted and the laps quadruple riveted.

The pumps are horizontal centrifugal type with 16-in. suction located in the bottom of the dock and are driven by a vertical shaft connected to a 50-H. P. motor located on top of dock. Two pumps are fitted in each section and all parts are interchangeable. The pumps have a capacity of 7,000 gallons per minute at 300 revolutions. The two pumps in each section are expected to empty the section in one hour and 20 minutes.

The Polson Iron Works is also building a new boiler shop, 300 x 120 ft., to be constructed entirely of steel except the boiler walls.

Twelfth International Congress of Navigation

The Twelfth International Congress of Navigation will be held at Philadelphia in June, 1912. The total membership of the congress is 2,089, and practically every country in the world is represented. The purpose of the congress is to promote the progress of inland and maritime navigation. The permanent seat of the congress is Brussels, Belgium, but congresses have been held at various intervals since 1885 in Belgium, Germany, Austria, England, France, Holland, Italy and Russia. The United States government invited the congress to hold its twelfth session at Philadelphia and the details of the congress are now being arranged by Lieut. Col. J. C. Sanford, room 344, Bourse, Philadelphia. A preliminary program has been arranged as follows:

First Section—Inland Navigation.

Questions.

1. Improvement of rivers by regulation and dredging and, if needs be, by reservoirs. Determination of the cases in which it is preferable to resort to such works rather than to canalization or the construction of a lateral canal.

2. Dimensions to be assigned, in any given country, to canals of heavy traffic. Principles of operating. Dimensions and equipment of the locks.

3. Intermediate and terminal ports. Best methods for combining, facilitating and harmonizing the transfer of freight between waterways and railways.

Communications.

1. Application of reinforced concrete to hydraulic works.

2. Report on the works undertaken and the measures adopted or proposed for the improvement and development of lines of inland navigation, as well as for the protection of the banks of navigable highways.

3. Utilization of the navigation of large but shallow rivers. Vessels and motors.

Second Section—Ocean Navigation.

Questions.

1. Means for docking and repairing vessels.

2. Dimensions to be given to maritime canals. (Technical point of view. Probable dimensions of sea-going vessels of the future.)

3. Mechanical equipment of ports.

Communications.

1. High powered dredges and means for removing rock under water.

2. Report on the most recent works constructed at the more important sea ports, especially those relating to breakwaters. Application of reinforced concrete. Means for insuring its preservation.

3. Bridges and ferry bridges; tunnels under waterways used for ocean navigation. Economic and technical study.

4. Safety of navigation. Lighted buoys.

The state of Pennsylvania has appropriated $25,000 towards defraying the expenses of the congress and the city government of Philadelphia will doubtless also contribute.

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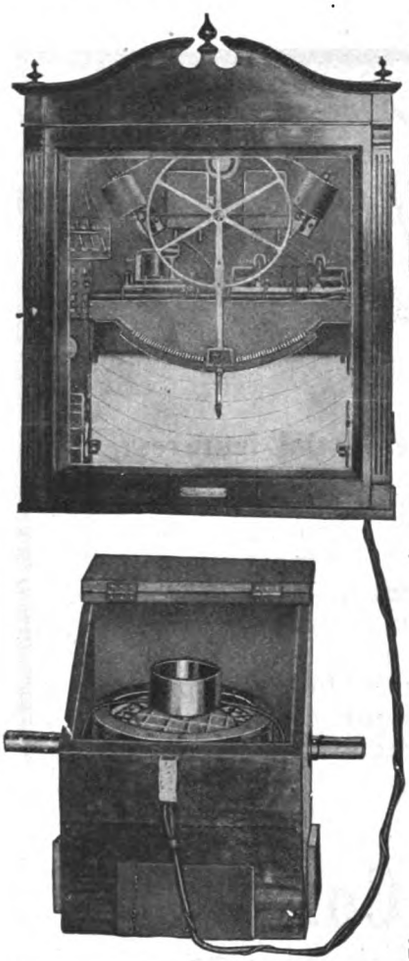

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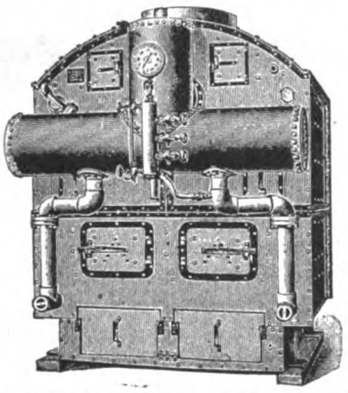

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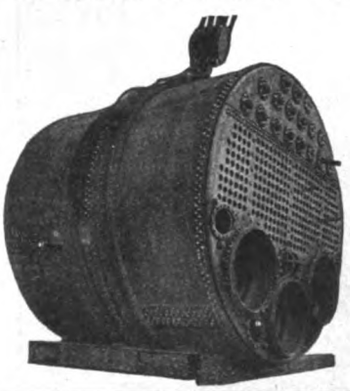

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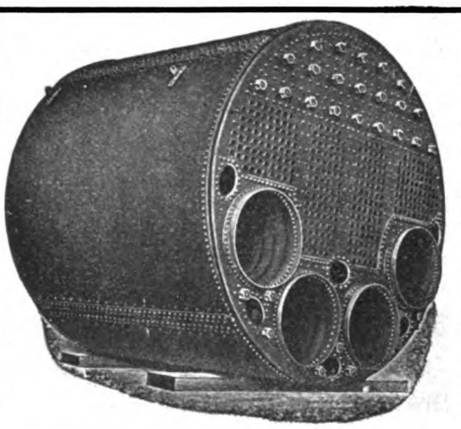

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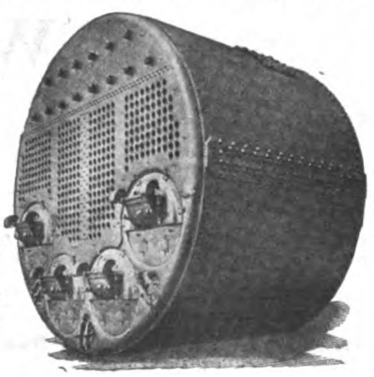

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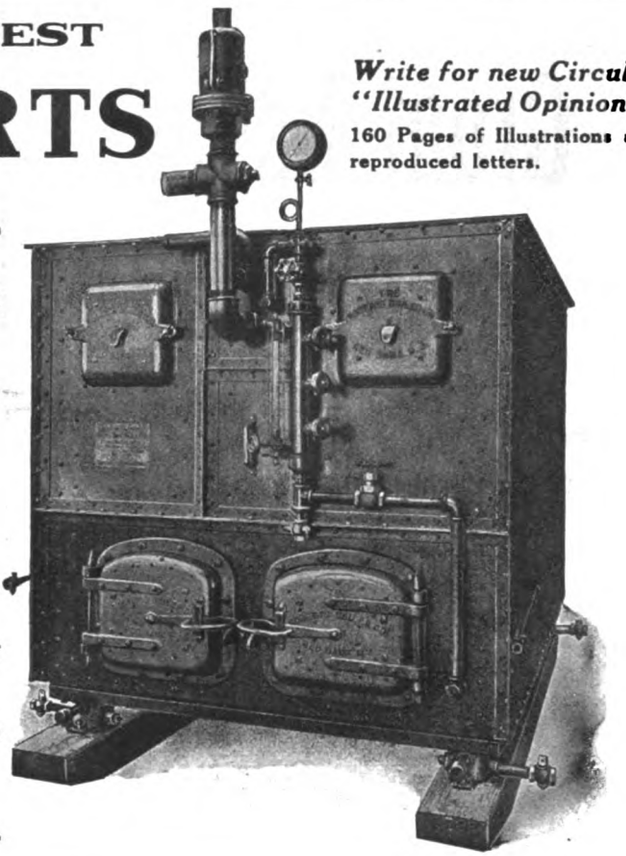

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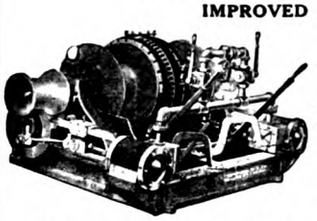

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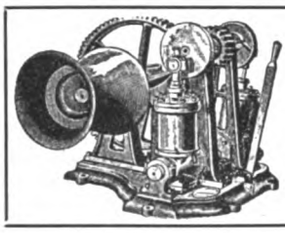

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FOR SALE BY

THE MARINE REVIEW, Cleveland

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1912 Marine Events have already cast their Shadows

The first returns from the Shipbuilders on the Atlantic Coast have been received, and as this increase will undoubtedly continue—

WATCH OUT FOR 1912

Glance Over These --

10 Freighters	valued at	$2,800,000
3 Oil Tankers	" "	750,000
3 Passenger Steamers . .	" "	1,500,000
3 Colliers	" "	3,200,000

Contracts for $8,250,000 have already been placed with Atlantic Coast Shipbuilders.

Just imagine what the complete statistics will show.

It will all be in the

Annual Shipbuilding Number

OF

The Marine Review

Complete detail as to where these vessels will be built, for whom and other information will be given, which will enable you to bid intelligently for your share of the business which will be placed the first of the year.

The one BEST—INEXPENSIVE method to have YOUR name mentioned as being able to supply certain marine necessities is representation in **The Shipbuilding Number of THE MARINE REVIEW.**

The fact that this will be retained throughout the year as a reference number, insures your name and product being at the pen-point of all the Shipbuilders, at a time when purchasing will be considered, if you are represented.

To Our Regular Patrons --

We cannot too strongly impress the value of large space in the coming **Shipbuilding Number.** We are especially anxious that you obtain your share of this business—hence we suggest using every effort to be represented with space which will enable you to place complete information regarding your product before these buyers. Our Service Department may simplify the matter of writing "copy-that-pulls"—and it is at your service.

Sign—tear on dotted line and return—TODAY

.....1911

The Marine Review
Cleveland, O.

We are interested in your **Shipbuilding Number,** and would like to hear further from you in regard to rates. We contemplate using.....page.

....

....

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The Marine or Scotch Type Boiler Perfected

BY APPLICATION OF

ECKLIFF AUTOMATIC BOILER CIRCULATOR

PATENTED

No dead water below grate levels.
Greater efficiency with a clean healthy boiler.
Steam raised in half ordinary time.
No ***pitting, furrowing or cracking*** of furnaces.

"Watch the Thermometer"

We prove that we create rapid and positive circulation by applying a thermometer at extreme bottom of boiler equipped with our system. No GUESSING or SUPPOSING.

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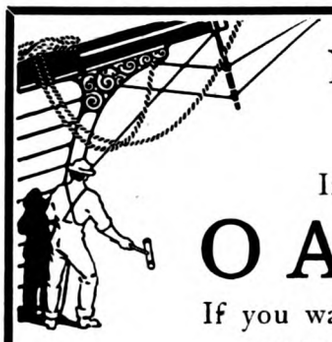
DETROIT, MICHIGAN



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No Sisal
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Back or Side Catch

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By PROF. W. F. DURANT

For Marine Engineers and Students, with aids for applicants for marine engineers' license.

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Improved Bolt Helmet

Write for our prices.

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Hawkins' Hand Book of Calculations for Engineers.
Hawkins' New Catechism of the Steam Engine.

THE MARINE REVIEW, CLEVELAND.

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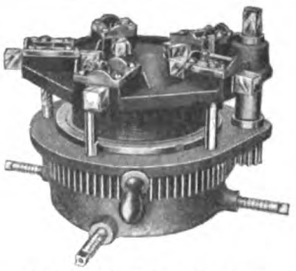
NIEDECKEN MIXER
(PATENTED)

Special Shower designed for Str. Col. J. M. Schoonmaker

Hoffmann & Billings Mfg. Co.
Write for Marine Bulletin N Milwaukee



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"OHIO SPECIAL"
MECHANICAL TUBES

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NEW YORK office, 2 Rector St.
CHICAGO office, Gas Bldg.
CLEVELAND office, B. of L. E. Bldg.
DETROIT office, Ford Bldg.

SHELBY, OHIO

WHERE TO BUY

AGENTS.
(Vessel and Freight.)

Boland & Cornelius..... 97
Hawgood & Co., W. A..... 97
Hutchinson & Co..... 97
McCarthy, T. R. 97
Mehl, Edward 97
Richardson, W. C. 97
Sullivan & Co., D..... 97
Vance & Joys Co..... 97

ANCHORS.

American Ship Windlass Co..... 2
Bowers & Co., L. M..... 18

APPARATUS.
(Steering.)

Akers Steering Gear Co..... —
American Ship Building Co..... 5
Chase Machine Co..... 12
Dake Engine Co..... 13
Detroit Ship Building Co..... 5
Hyde Windlass Co..... 100
Sheriffs Mfg. Co. 91

APPARATUS.
(Submarine Diving.)

Morse & Son, A. J..... 88
Schrader's Son, Inc., A..... 90

ARCHITECTS.
(Naval.)

Babcock & Penton..... 96
Brady, F. W..... 96
Curr, Robert 96
Furstenau, M. C..... 96
Kidd, Joseph 96
Hynd, Alexander 96
Watts, J. Murray 96

ARMORS.
(Submarine.)

Morse & Son, A. J..... 88
Schrader's Son, Inc., A..... 90

ATTORNEYS AND PROCTORS IN ADMIRALTY.

Gilchrist, Albert J..... 96
Goulder, Day, White & Garry..... 96
Holding, Masten, Duncan & Leckie..... 96
Hoyt, Dustin, Kelley, McKeehan & Andrews 96
Kremer, C. E..... 96
Shaw, Warren, Cady & Oakes..... 96

BARS.
(Iron or Steel—Hollow Staybolt.)

Falls Hollow Staybolt Co..... 86

BEACONS.

Safety Car Heating & Lighting Co..... 21

BEARINGS.
(Bronze and Graphite.)

Graphite Lubricating Co..... 18

BELLS.
(Engine Room, Telegraph, Call, Etc.)

Cory & Son, Chas..... 17
National Tube Co..... 17

BINNACLES.

Ritchie, E. S., & Sons..... 91

BLOCKS.
(Tackle.)

Boston & Lockport Block Co..... 91

BLOWERS.

American Blower Co..... 425

BOATS.
(Builders.)

Drein, Thos., & Son..... 97

BOATS.
(Steel Sectional.)

Ward, Chas., Engineering Works..... 85

BOOKS.

Penton Publishing Co., The..... —

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WHERE TO BUY

BOILERS.
(Marine.)

Almy Water Tube Boiler Co..... 86
American Ship Building Co..... 5
Bath Iron Works..... 10
Chicago Ship Building Co..... 6
Clyde Ship Building & Engrg. Co..... 12
Commercial Boiler Works..... 86
Delaney, P., & Co..... 86
Detroit Ship Building Co..... 5
Fletcher, W. A., & Co..... 10
Great Lakes Engrg. Works..... 26
Johnston Bros. 8
Kingsford Fdy. & Mach. Works..... 86
Manistee Iron Works Co..... 15
Manitowoc Ship Bldg. & Dry Dock Co.. 11
Milwaukee Dry Dock Co..... 7
Moran Co. 10
Mosher Water Tube Boiler Co..... 425
New York Ship Building Co..... 9
Roberts Safety Water Tube Boiler Co... 87
Superior Ship Building Co..... 6
Toledo Ship Building Co..... 4
Ward, Chas., Engineering Works..... 85

BRASS GOODS.

Penberthy Injector Co..... 100

BUCKETS.
(Excavating.)

Biehl, B. F..... 90
Hayward Co., The 22

BUCKETS.
(Ore and Coal.)

Hayward Co., The 22

BUOYS, BOATS, PRESERVERS, ETC.
(Life.)

Armstrong Cork Co..... 23
Drein & Son, Thos..... 97
Kahnweiler's Sons, David..... 99

BUOYS.

American Gas-Accumulator Co..... 21

BUOYS.
(Gas.)

Safety Car Heating & Lighting Co..... 21

BUOYS.
(Spar.)

Safety Car Heating & Lighting Co..... 21

BUSHINGS.
(Adjustable.)

Armstrong Mfg. Co..... 99

BUSHINGS.
(Bronze and Graphite.)

Graphite Lubricating Co..... 18

CABLES.

American Steel & Wire Co..... 24
Columbian Rope Co..... 85
Durable Wire Rope Co..... 25
Erie Mill & Marine Supply Co..... 87

CAPSTANS.

American Ship Windlass Co..... 2
Chase Machine Co..... 12
Dake Engine Co..... 13
Hyde Windlass Co..... 100

CASTINGS.
(Brass and Bronze.)

Dake Engine Co..... 13
Great Lakes Engrg. Works..... 26
Trout Co., H. G..... 91

CASTINGS.
(Steel.)

Otis Steel Co., Ltd..... 22

CHANDLERS.
(Ship.)

Erie Mill & Marine Supply Co..... 87

CHARTS.

Penton Publishing Co., Cleveland..... —

CHOCKS.

American Ship Windlass Co..... 2

CIRCULATORS.
(Boiler.)

Eckliff Automatic Boiler Circ'l'r Co..... 90

CLEANERS.
(Boiler Tube.)

Diamond Power Specialty Co..... 14

COAL.
(Producers and Shippers.)

Hall, Geo., Coal Co..... 87
Hanna, M. A., & Co..... 94
Lorain Coal & Dock Co..... 94
Pickands, Mather & Co..... 94

COCKS.

National Tube Co..... 17

COILS.
(Pipe.)

National Tube Co..... 17

COLUMNS.
(Gage—Water.)

National Tube Co..... 17

COMPASSES.

Ritchie, E. S., & Sons..... 91

CONDENSERS.

Great Lakes Engrg. Works..... 26
Griscom-Spencer Co. 99
Williamson Brothers Co..... 2

CONTRACTORS.
(Dredging.)

Breymann & Bros., G. H..... 92
Buffalo Dredging Co..... 93
Dunbar & Sullivan Dredging Co..... 92
Great Lakes Dredge & Dock Co..... 23
Starke Dredge & Dock Co., C. H..... 92
Sullivan, M. 93

CONTRACTORS.
(Pile Driving and Submarine.)

Buffalo Dredging Co..... 93
Dunbar & Sullivan Dredging Co..... 92
Great Lakes Dredge & Dock Co..... 23
Starke Dredge & Dock Co., C. H..... 92
Sullivan, M. 93

CONTRACTORS.
(Public Work.)

Breymann & Bros., G. H..... 92
Buffalo Dredging Co..... 93
Dunbar & Sullivan Dredging Co..... 92
Great Lakes Dredge & Dock Co..... 23
Starke Dredge & Dock Co., C. H..... 92
Sullivan, M. 93

CONVEYORS.
(Chain.)

Bartlett & Snow Co., C. O..... 88

CORDAGE.

Columbian Rope Co..... 85
Erie Mill & Marine Supply Co..... 87

COVERS.
(Water-Proof.)

Peerless Rubber Mfg. Co..... 19

COUPLINGS.

National Tube Co..... 17

CRANES.
(Dock.)

Williamson Brothers Co..... 2

CRANES.
(Electric Boat.)

Williamson Brothers Co..... 2

CRANES.
(Locomotive.)

Williamson Brothers Co..... 2

CUPS.
(Oil and Grease.)

Penberthy Injector Co..... 100

CUTTERS.
(Pipe.)

Armstrong Mfg. Co..... 99

DERRICKS.

Dake Engine Co..... 13
Hayward Co., The..... 22
Lidgerwood Mfg. Co..... 87
Superior Iron Works..... 14

DESIGNERS.
(Ship.)

Babcock & Penton..... 96
Curr, Robt. 96
Furstenau, M. C. 96
Kidd, Joseph 96
Hynd, Alexander 96

DIES.

Armstrong Mfg. Co..... 99

DISCS.
(Valve, Etc.)

Peerless Rubber Mfg. Co..... 19

DIVING APPARATUS.

Morse & Son, A. J..... 88
Schrader's Son, Inc., A..... 90

DOCKS.
(Dry.)

American Ship Building Co..... 5
Buffalo Dry Dock Co..... 7
Chicago Ship Building Co..... 6
Collingwood Ship Building Co..... 8
Detroit Ship Building Co..... 5
Empire Ship Building Co..... 88
Great Lakes Engrg. Works..... 26
Manitowoc Ship Bldg. & Dry Dock Co... 11
Milwaukee Dry Dock Co..... 7
Moran Co. 10
Superior Ship Building Co..... 6
Tietjen & Lang Dry Dock Co..... 12
Toledo Ship Building Co..... 4

DRAFT.
(Artificial and Mechanical for Boilers.)

American Blower Co..... 425
American Ship Building Co..... 5
Detroit Ship Building Co..... 5
Great Lakes Engrg. Works..... 26

DROPS.
(Wharf.)

American Ship Windlass Co..... 2

EJECTORS.

Penberthy Injector Co..... 100

EJECTORS.
(Ash.)

Great Lakes Engrg. Works..... 26

ENGINEERS.
(Marine, Mechanical and Consulting.)

Babcock & Penton..... 96
Brady, F. W..... 96
Furstenau, M. C..... 96
Griscom-Spencer Co..... 99
Hunt, Robt. W., & Co..... 96
Kidd, Joseph 96
Hynd, Alexander 96
Roelker, H. B..... 20
Watts, J. Murray 96

ENGINES.

Chase Machine Co..... 12
Superior Iron Works..... 14
Williamson Brothers Co..... 2

ENGINES.
(Hoisting.)

American Blower Co. 425
Chase Machine Co. 12
Lidgerwood Mfg. Co..... 87
Marine Iron Co..... 88
Williamson Brothers Co..... 2

ENGINES.
(Marine.)

American Blower Co. 425
American Ship Building Co..... 5
Bath Iron Works..... 10
Chicago Ship Building Co..... 6
Chase Machine Co..... 12
Clyde Ship Building & Engrg. Co..... 12
Collingwood Ship Building Co..... 8
Detroit Ship Building Co..... 5
Fletcher, W. A., Co..... 10
Fore River Ship Building Co..... 97
Great Lakes Engrg. Works..... 26
Johnston Bros. 8
Manistee Iron Works Co..... 15
Manitowoc Ship Bldg. & Dry Dock Co.. 11
Milwaukee Dry Dock Co..... 7
Moran Co. 10
New York Ship Building Co..... 9
Sheriffs Mfg. Co. 91
Superior Ship Building Co..... 6
Toledo Ship Building Co..... 4
Trout, H. G. 91
Ward, Chas., Engineering Works..... 85

ENGINES.
(Mooring.)

Chase Machine Co..... 12
Lidgerwood Mfg. Co..... 87
Williamson Brothers Co..... 2

ENGINES.
(Steering.)

Hyde Windlass Co..... 100
Lidgerwood Mfg. Co..... 87
Williamson Brothers Co..... 2

EVAPORATORS.

Griscom-Spencer Co. 99

EXTRACTORS.
(Grease.)

Griscom-Spencer Co. 99

FANS.

American Blower Co..... 425

FASTENERS.
(Hatch.)

Hynd, Alexander 96

FILTERS.
(Feed Water.)

Griscom-Spencer Co. 99
Ross Valve Mfg. Co..... 17

FITTINGS.
(Boiler.)

National Tube Co..... 17

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WHERE TO BUY

FUELING COMPANIES AND COAL DEALERS.

Hall, Geo., Coal Co..... 87
Hanna & Co., M. A..... 94
Lorain Coal & Dock Co..... 94
Pickands, Mather & Co..... 94

FURNACES.
(For Boilers.)

Continental Iron Works..... 2

GAGES.
(Steam.)

Ashton Valve Co..... 16

GAGES.
(Water.)

Jenkins Bros. 100
Penberthy Injector Co..... 100

GASKETS.

Peerless Rubber Mfg. Co..... 19

GEARS.
(Steering.)

Akers Steering Gear Co..... —
American Ship Building Co..... 5
American Ship Windlass Co..... 2
Chase Machine Co..... 12
Dake Engine Co..... 13
Detroit Ship Building Co..... 5
Hyde Windlass Co..... 100
Sheriffs Mfg. Co. 91

GRAPHITE.

Dixon Crucible Co., Joseph..... 99

GRAPHITE.
(Lubricating.)

Dixon Crucible Co., Joseph..... 99

GYPSEYS.
(Steam.)

American Ship Windlass Co..... 2

HAMMERS.
(Steam.)

Chase Machine Co..... 12

HARDWARE.
(Marine.)

Erie Mill & Marine Supply Co..... 87

HEATERS AND PURIFIERS.
(Feed-Water.)

Griscom-Spencer Co. 99
Ross Valve Mfg. Co..... 17

HOISTERS.
(Ferrall's Cargo.)

Boston & Lockport Block Co..... 91

HOISTS.
(Air.)

Great Lakes Engrg. Works..... 26

HOISTS.
(Cargo, Etc.)

American Ship Building Co..... 5
Boston & Lockport Block Co..... 91
Chase Machine Co..... 12
Dake Engine Co..... 13
Hyde Windlass Co..... 100
Williamson Brothers Co..... 2

HOISTS.
(Chain.)

Dake Engine Co..... 13

HOISTS.
(Electric.)

Lidgerwood Mfg. Co..... 87
Williamson Brothers Co..... 2

HOISTS.
(Pneumatic.)

Dake Engine Co..... 13

HOSE.
(Fire and Steam.)

Peerless Rubber Mfg. Co..... 19

INJECTORS.

American Injector Co..... 16
Jenkins Bros. 100
Penberthy Injector Co..... 100

INSTRUMENTS.
(Nautical.)

Ritchie, E. S., & Sons..... 91
Schuette Recording Compass Co..... 85

INSURANCE.
(Marine.)

Boland & Cornelius 97
Hawgood & Co., W. A..... 97
Hutchinson & Co..... 97
McCarthy, T. R. 97
Mehl, Edward 97
Richardson, W. C. 97
Sullivan & Co., D..... 97
Vance & Joys Co..... 97
Willcox, Peck & Hughes..... 20

IRON.
(Pig.)

Hanna & Co., M. A..... 94
Pickands, Mather & Co..... 94

INVENTIONS.
(Special.)

Boucher, H. E., Mfg. Co..... 88

JACKETS.
(Cork.)

Armstrong Cork Co..... 23
Kahnweiler's Sons, David 99

JOINTS.
(Expansion.)

National Tube Co..... 17

LAMPS AND LANTERNS.
(Ship.)

Erie Mill & Marine Supply Co..... 87

LANTERNS.
(Buoy.)

Safety Car Heating & Lighting Co..... 21

LAUNCHES.

Drein, Thos., & Son..... 97

LIGHTS.
(Acetylene.)

U. S. Marine Signal Co..... 18

LIGHTS.
(Electric.)

Cory & Son, Chas..... 17

LIGHTS.
(Flare.)

U. S. Marine Signal Co..... 18

LIGHTS.
(Search.)

U. S. Marine Signal Co..... 18

LOGS.

Schuette Recording Compass Co..... 85
Walker & Sons, Thomas..... 3

LUBRICATORS.

Penberthy Injector Co..... 100

LUMBER.

Martin-Barriss Co. 25

MACHINERY.
(Coal and Ore Handling.)

Bartlett, C. O., & Snow Co..... 88
Hayward Co., The 22

MACHINERY.
(Dredging.)

Biehl, B. F..... 90
Chase Machine Co..... 12
Great Lakes Engrg. Works..... 26
Hayward Co., The 22
Marine Iron Co..... 88
Superior Iron Works..... 14
Williamson Brothers Co..... 2

MACHINERY.
(Marine.)

American Ship Building Co..... 5
Chase Machine Co..... 12
Chicago Ship Building Co..... 6
Clyde Ship Building & Engrg. Co..... 12
Collingwood Ship Building Co..... 8
Dake Engine Co..... 13
Detroit Ship Building Co..... 5
Empire Ship Building Co..... 88
Fletcher Co., W. & A..... 10
Great Lakes Engrg. Works..... 26
Johnston Bros. 8
Manistee Iron Works..... 15
Manitowoc Ship Bldg. & Dry Dock Co... 11
Moran Co., The..... 10
New York Ship Building Co..... 9
Sheriffs Mfg. Co. 91
Superior Iron Works..... 14
Toledo Ship Building Co..... 4

MACHINERY.
(Refrigerating.)

Roelker, H. B..... 20

MACHINERY.
(Special.)

Boucher, H. E., Mfg. Co..... 88

MACHINES.
(Towing.)

American Ship Windlass Co..... 2
Chase Machine Co..... 12

MACHINISTS.

Chase Machine Co..... 12
Superior Iron Works..... 14

MODELS.
(Marine.)

Boucher, H. E., Mfg. Co..... 88

NOZZLES.
(For Fire Hose.)

Morse & Son, A. J..... 88

OAKUM.

Davey, W. O., & Sons..... 425
Stratford Oakum Co., Geo..... 90

OILS AND LUBRICANTS.

Dixon Crucible Co., Joseph..... 99

ORE.
(Iron.)

Hanna & Co., M. A..... 94
Pickands, Mather & Co..... 94

PACKING.

Home Rubber Co..... 19
Jenkins Bros. 100
Katzenstein, L., & Co..... 17
Peerless Rubber Mfg. Co..... 19
Revere Rubber Co..... 19

PACKING.
(Metallic.)

Katzenstein, L., & Co..... 17

PACKING.
(Sheet Rubber.)

Peerless Rubber Mfg. Co..... 19

PACKING.
(Spiral and Coil.)

Peerless Rubber Mfg. Co..... 19

PATENTS.

Siggers & Siggers..... 97

PIPE.

National Tube Co..... 17

PIPE THREADERS.

Toledo Pipe Threading Mach. Co.....Insert

PLANTS.
(Ice Making.)

Brunswick Refrigerating Co..... 20

PLATES AND SHAPES.
(Ship and Boiler.)

Otis Steel Co., Ltd..... 22

POSTS.
(Tow.)

Montague Iron Works Co.....Insert

PRESERVERS.
(Life, Life Boats, Buoy, Etc.)

Armstrong Cork Co..... 23
Drein, Thos., & Son..... 97
Kahnweiler's, David, Sons..... 99

PUMPS AND APPLIANCES.
(Air.)

Great Lakes Engrg. Works..... 26
Kingsford Fdy. & Mach. Co..... 86

PUMPS.
(For Various Purposes.)

Great Lakes Engrg. Works..... 26
Kingsford Fdy. & Mach. Co..... 86
Manistee Iron Works 15
Roelker, H. B..... 20

RADIATORS.

National Tube Co..... 17

REGISTERS FOR CLASSIFICATION OF VESSELS.

Great Lakes Register Co..... 88

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WHERE TO BUY

REGULATORS.
(Pressure.)

Ross Valve Mfg. Co..... 17

REPAIRS.
(Marine.)

American Ship Building Co..... 5
Buffalo Dry Dock Co..... 7
Chicago Ship Building Co..... 6
Clyde Ship Building & Engrg. Co..... 12
Collingwood Ship Building Co..... 8
Delany, P., & Co..... 86
Detroit Ship Building Co..... 5
Empire Ship Building Co..... 88
Goldschmidt Thermit Co..... 425
Great Lakes Engrg. Works..... 26
Griscom-Spencer Co. 99
Johnston Bros. 8
Manitowoc Ship Bldg. & Dry Dock Co.. 11
Milwaukee Dry Dock Co..... 7
Moran Co. 10
New York Ship Building Co..... 9
St. Lawrence Marine Ry. Co..... 87
Sheriffs Mfg. Co..... 91
Superior Ship Building Co..... 6
Tietjen & Lang Dry Dock Co..... 12
Toledo Ship Building Co..... 4

RINGS.
(Cork.)

Armstrong Cork Co. 23
Kahnweiler's Sons, David..... 99

RIVETS.
(Steel for Ships and Boilers.)

Great Lakes Engrg. Works..... 26

ROPE.

Columbian Rope Co..... 85
Durable Wire Rope Co..... 25
Erie Mill & Marine Supply Co..... 87
Wall Rope Works of New York..Front cover

ROPE AND FITTINGS.
(Wire.)

American Steel & Wire Co..... 24
Durable Wire Rope Co..... 25
Erie Mill & Marine Supply Co..... 87

SCOWS.
(Fueling.)

Bartlett, C. O., & Snow Co..... 88

SHAPES AND PLATES.
(Ship and Boiler.)

Otis Steel Co., Ltd..... 22

SHEAVES.

Boston & Lockport Block Co..... 91

SHIP BUILDING SYSTEM.

Isherwood, J. W. 3

SHIPS.
(Builders.)

American Ship Building Co..... 5
Bath Iron Works..... 10
Buffalo Dry Dock Co..... 7
Clyde Ship Building & Engrg. Co..... 12
Collingwood Ship Building Co..... 8
Chicago Ship Building Co..... 6
Detroit Ship Building Co..... 5
Empire Ship Building Co..... 88
Fletcher Co., W. & A..... 10
Fore River Ship Building Co..... 97
Great Lakes Engrg. Works..... 26
Isherwood, J. W. 3
Johnston Bros. 8
Manitowoc Ship Bldg. & Dry Dock Co.. 11
Milwaukee Dry Dock Co..... 7
Moran Co. 10
New York Ship Building Co..... 9
Superior Ship Building Co..... 6
Tietjen & Lang Dry Dock Co..... 12
Toledo Ship Building Co..... 4

SHOWERS.

Hoffmann & Billings Mfg. Co.....Insert

SPECIALTIES.
(Steam.)

Griscom-Spencer Co. 99
Hynd, Alexander 96
Jenkins Bros. 100
Peerless Rubber Mfg. Co..... 19
Penberthy Injector Co..... 100
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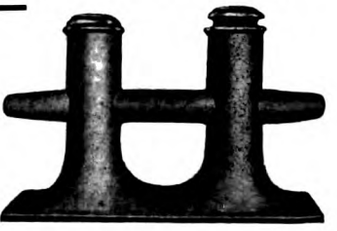

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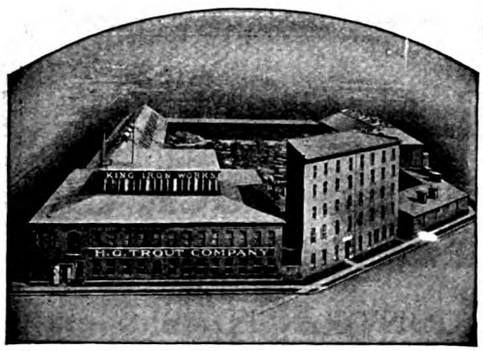

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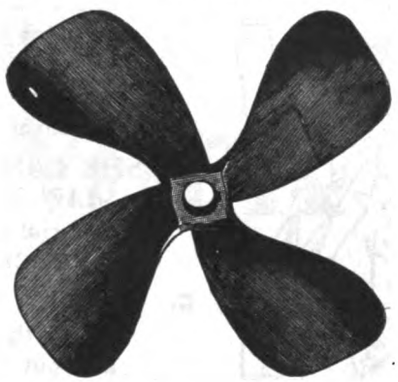

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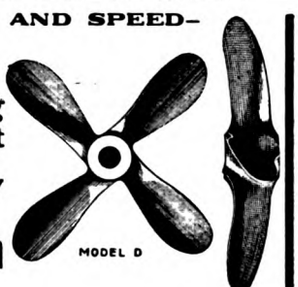

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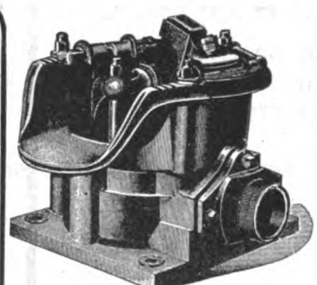

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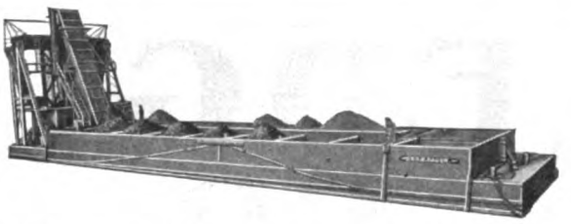

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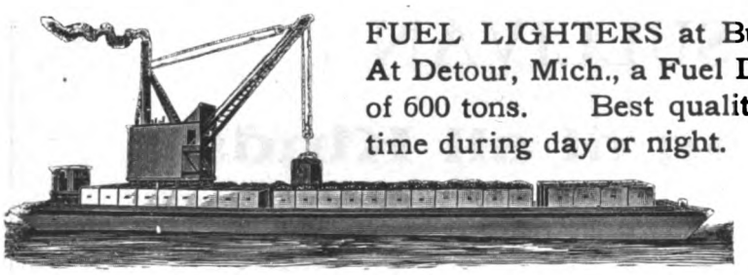

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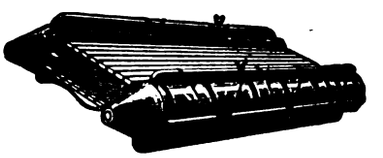

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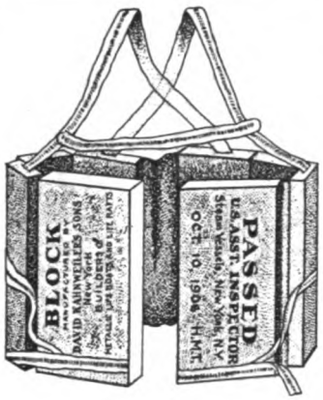

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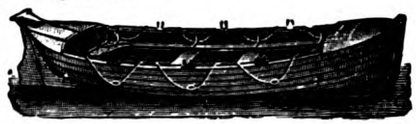

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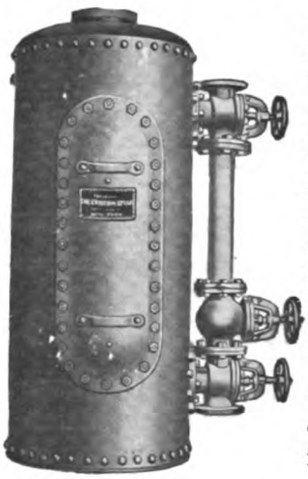

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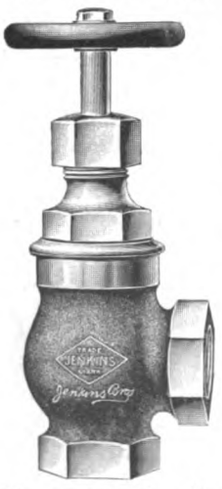

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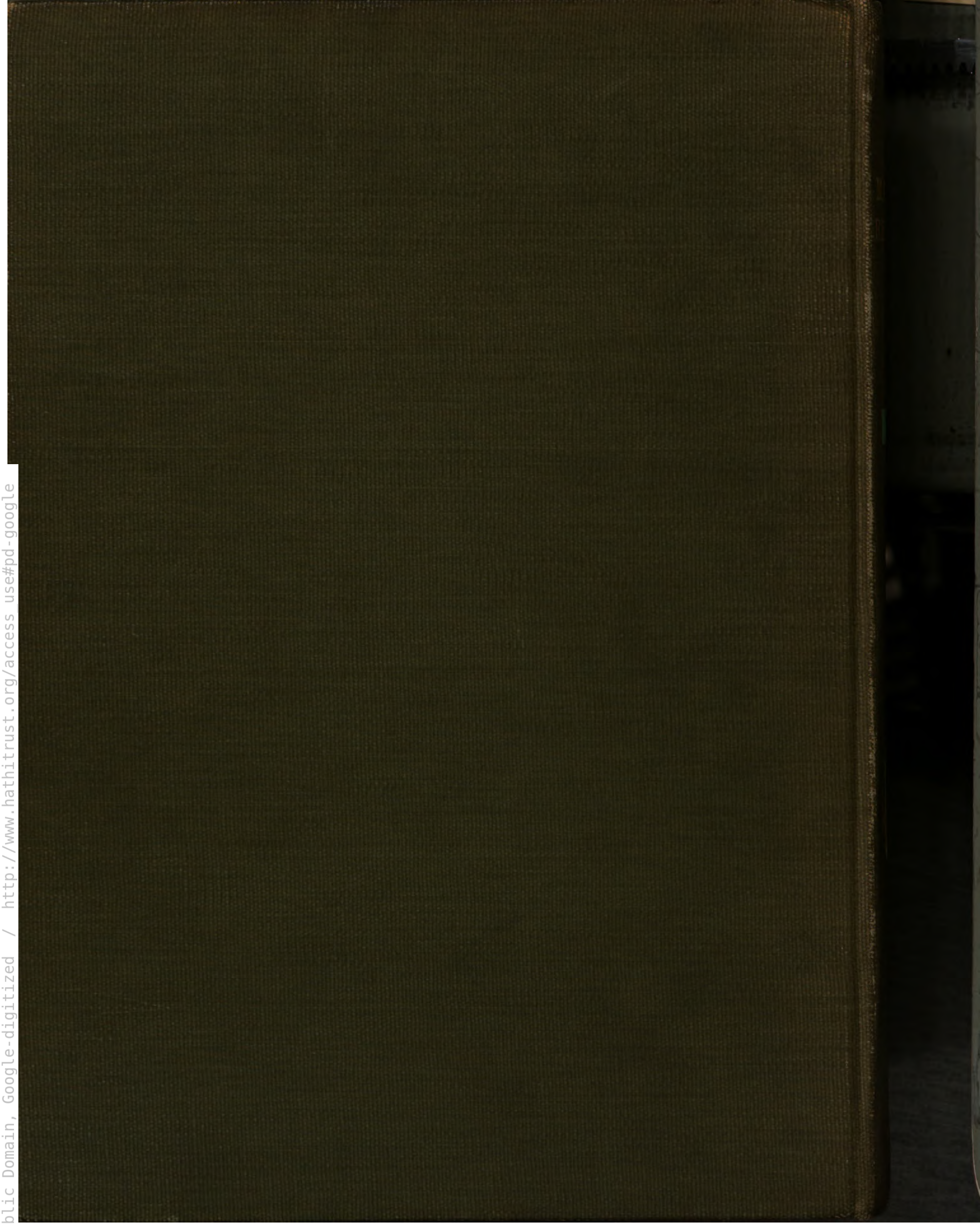

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